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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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ASTRONAUTICS

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ENGINEERING

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74 OPTICS 674
Includes light phenomena.

75 PLASMA PHYSICS 677
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 680
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 686
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 686
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 688
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 690
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 691
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 691
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 692
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 692
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 693
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 693
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 694
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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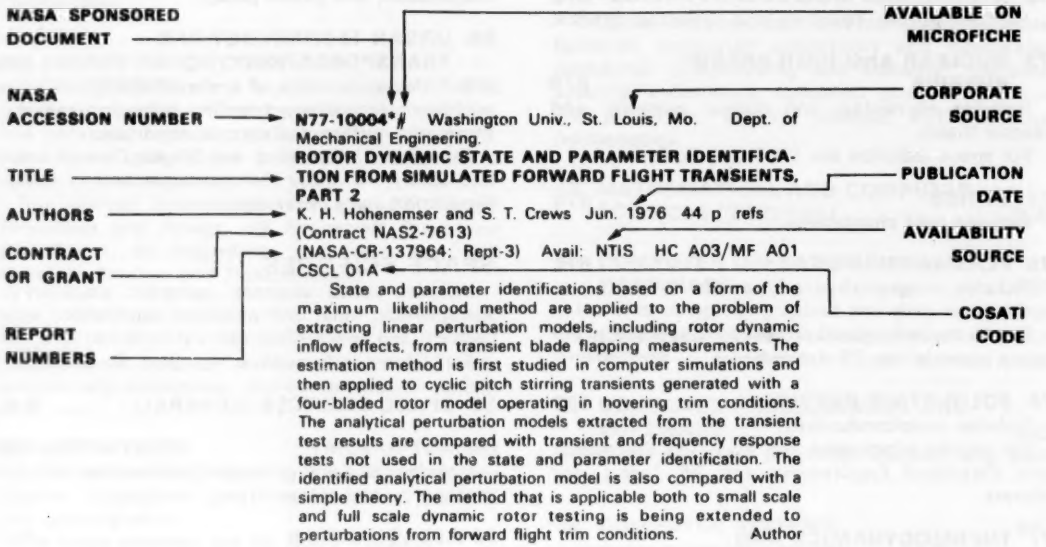
TYPICAL CITATION AND ABSTRACT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N77-10004*# Washington Univ., St. Louis, Mo. Dept. of Mechanical Engineering.
ROTOR DYNAMIC STATE AND PARAMETER IDENTIFICATION FROM SIMULATED FORWARD FLIGHT TRANSIENTS, PART 2
K. H. Hohenemser and S. T. Crews Jun. 1976 44 p refs
(Contract NAS2-7613)
(NASA-CR-137964; Rept-3) Avail: NTIS HC A03/MF A01
CSCL 01A
State and parameter identifications based on a form of the maximum likelihood method are applied to the problem of extracting linear perturbation models, including rotor dynamic inflow effects, from transient blade flapping measurements. The estimation method is first studied in computer simulations and then applied to cyclic pitch stirring transients generated with a four-bladed rotor model operating in hovering trim conditions. The analytical perturbation models extracted from the transient test results are compared with transient and frequency response tests not used in the state and parameter identification. The identified analytical perturbation model is also compared with a simple theory. The method that is applicable both to small scale and full scale dynamic rotor testing is being extended to perturbations from forward flight trim conditions. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, MECHANISMS OF MAGNETOPLASMADYNAMIC ARC JET ACCELERATION PROCESSES
G.L. CANN, Technion Incorporated, *Newport Beach, California* (DF037860; F44620-74-C-0017)

AF function - satellite surveillance, communications and navigation, advanced electric propulsion engines. Deficiency - insufficient fundamental understanding of basic mechanisms and physical processes of low-temperature plasma generation and acceleration associated with using the atmospheric environment as an arc jet propellant source for an MPD arc-operated space thruster and lack of experimental evidence and realistic guidelines for defining capabilities and predicting system performance. Objective - to understand and develop theoretical and analytical models accurately describing the plasma generation, acceleration and loss phenomena associated with the MPD arc-operated space electric ramjet using ambient atmosphere as the propellant source (i.e., SERJ), to obtain critical experimental data to evaluate the analytical models and the SERJ concept. How work contributes - will provide additional understanding and realistic analytical modeling of the plasma generation and acceleration processes via MPD arcs using ambient atmosphere as propellant and will contribute to the technology base required for realistic evaluation and development of the SERJ concept as an effective and efficient plasma space propulsion engine.

Theoretical and experimental studies of plasma generators and acceleration phenomena associated with the use of the ambient atmosphere as the propellant source for an MPD arc operated as a space electric ram jet (SERJ) will be carried out. Processes producing strong interaction between the accelerating discharge and ambient medium will be investigated. Fundamental studies of ion production, acceleration and electrode attachment mechanisms in the relevant pressure and current density regime will determine the interaction parameters between the discharge and tenuous atmosphere as the parameters affecting the power loss and electrode lifetimes in SERJ-MPD arc devices. Techniques of utilizing the ambient charged particle in the ionosphere for charged particle and thrust production will be investigated. The adsorptive collection of air on electrode surfaces will be investigated to determine its influence upon electrode performance. The effectiveness of using a combination of the self-magnetic field with a solenoidal magnetic field operating in a quasi-steady mode to produce the accelerating force will be studied in terms of the mass and energy utilization efficiency. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0002, DEMONSTRATE FEASIBILITY OF MAIN ROTOR BLADE FOR THE H-3 HELICOPTER
UNKNOWN, United Aircraft Corporation, *Stratford, Connecticut* 06497 (DN330030; N00019-73-C-0319)

The use of composite construction in this rotor blade will facilitate advanced aerodynamic geometry in the blade to obtain anticipated improvement in hover performance and increase in cruise speed. Demonstration of such improvement would be as limited by current power and structural limitations of the H-3 helicopter. However, additional performance growth will be possible for future helicopters having appropriate power and structural capabilities and utilizing this type of rotor blade. The knowledge gained from this work will be applicable in general to all future helicopter rotor systems incorporating this type of blade construction.

The blade construction planned involves the use of the Sikorsky twin beam rotor concept. This program includes three phases as follows: (1) preliminary design, fabrication and test, (2) detail design and fabrication of full-sized hardware, (3) testing (static and fatigue tests, whirl and flight tests).

ADDENDA: Supporting Agency Address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0003, PRESSURE VARIABLE RATIO (HTFT)
D.J. HELTON, General Motors Corporation, *Indianapolis, Indiana* 46206 (DF459580; F33615-76-C-2068)

To improve the advantages of the variable-cycle engine via maximizing the operating temperature.

Develop the technology to increase cycle temperature and reduce cooling air requirements so as to achieve a non-afterburning engine with performance superior to lower temperature augmented engines.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0004, AERONAUTICAL TECHNOLOGY - VULNERABILITY REDUCTION
R.G. BERNIER, U.S. Army, Ballistic Research Labs., *Aberdeen Proving Ground, Maryland* 21005 (DA0L4468)

Further research into the vulnerability of Army aircraft fuel systems, power plants, power trains, flight controls, rotor blades and aircraft structures through modeling, combat damage analysis and exploitation of new protection concepts. Pilot vulnerability will also be studied.

Support, train and guide AMRDL-Eustis vulnerability analysis team. Conduct further R&D testing, analysis and methodology development.

ADDENDA: Supporting Agency Address is: Darcom Ballistic Research Labs, Aberdeen PG MD 21005

SUPPORTED BY U.S. Dept. of Defense - Army

1.0005, IN-FLIGHT THRUST CONTROL
M.W. COVEY, U.S. Navy, Air Test Center, *Patuxent River, Maryland* 20670 (DN037010)

Develop and flight test prototype hardware in order to evaluate the feasibility of the concept. Flight tests to include functional flying qualities, durability, evaluation of thrust reverser for various missions. Determine suitability of hardware for thrust engine operation effects, performance and employment of techniques for augmentor wing concept, and as an aid in air combat maneuvering (ACM) engagements.

Develop and flight test prototype hardware in order to evaluate the feasibility of the concept.

ADDENDA: Supporting Agency Address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0006, TECHNICAL SUPPORT FOR THE MICROWAVE LANDING SYSTEM DEVELOPMENT PROGRAM
UNKNOWN, Vitro Laboratories, *Silver Spring, Maryland* 20910 (FA36303; FA72WA-3010)

Technical services in support of the many engineering tasks that must be accomplished during the development program for the microwave landing system (MLS). The basic role of the contractor is to provide direct assistance and support to the MLS Program Management Office in the performance of its system engineering functions. This includes active participation in planning, coordinating, and assessing results of development efforts of MLS program.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

1.0007, ENGINEERING SUPPORT FOR PROTOTYPE ADVANCED MEDIUM STOL TRANSPORT (AMST) AIRCRAFT
P.J. MACEK, U.S. Army, Natick Research & Dev. Command, *Natick, Massachusetts* 01760 (DA0G4256)

Supplement the AMST Army Coordination Office with engineering and technical support for the airdrop test program of two prototype aircraft (Boeing YC-14 and the McDonnell-Douglas YC-15). Assist in the preparation of the AMC Headquarters AMST assessment plan. Review Air Force and contractor plans of test to assure that critical Army interest areas are considered. Assist in the design of specific tests and in the preparation of flight test cards. Monitor and participate in the scheduled airdrop flight test programs. Evaluate test results and furnish the Army Coordination Office with an engineering test report.

Prepare assessment plans, review test plans, prepare flight test cards and recommend test designs which will insure recording of test results required by the Army in its engineering evaluation of two AMST prototypes. Review films, telemetry traces and anetheodolite trajectory space positioning reports to determine the adequacy of the AMST prototypes as airdrop aircraft in support of the Army's airborne assault mission.

ADDENDA: Supporting Agency Address is: Naradcom Natick R & D Command, ATTN: DRXNM-UBS, Natick, Mass. 01760

SUPPORTED BY U.S. Dept. of Defense - Army

1.0008, PHASE-DERIVED NAVIGATION
H.C. SALWEN, Proteon Associates Inc., *Waltham, Massachusetts* 02154 (DF900290; F19628-76-C-0040)

AF function - aircraft landing aids. Deficiency - in addition to the present transition from instrument landing system (ILS) to microwave landing system (MLS) techniques a requirement exists for an independent landing monitor system (LMS) to check on the primary system and to serve as a confidence builder for the pilot landing in adverse weather. Objective - to develop and investigate basic components of an aircraft perspective system. How research contributes - an experimental three- beacon transmitter two-receiver system is designed and integrated with a computer/graphic display to generate CRT perspective presentations of the multiple transmitter positions based on incremental range and phase difference data. Special emphasis is placed on multipath interference suppression.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETE, Griffiss AFB, N.Y. 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0009, MATERIAL CHARACTERIZATION PROCEDURES FOR DESIGN OF PAVEMENTS
W.N. BRABSTON, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0L8185)

To develop methodology for characterizing the structural properties of various types of pavement materials and to formulate this methodology into definitive procedures that will yield quantitative parmeters for design of road and airfield pavements using existing or newly developed theoretical and semi-theoretical criteria.

A range of materials that are acceptable for use in the design of pavements will be considered. Various types of laboratory test procedures will be studied to determine methods of integrating the quantitative output of acceptable laboratory tests with conventional material acceptability standards such as gradation, plasticity, etc. Material characterization procedures will be developed to provide the user with direct and/or indirect methods of obtaining quantitative design parameters.

ADDENDA: Supporting Agency Address is: OCE U.S. Army Engineer Waterways Experiment Station, P.O. Box 631, Vicksburg, Mass. 39180

SUPPORTED BY U.S. Dept. of Defense - Army

1.0010, RAPID RUNWAY REPAIR
R.H. DENSON, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0W8180)

To develop a program for using the regulated-set cement repair system for rapid runway repair at a designated US air base in Europe. The program will include establishing materials, equipment, and personnel plans, training of personnel, implementation of a full-scale repair of one large crater and numerous small craters and provision of necessary laboratory and field support. Information generated will be compiled for inclusion in appropriate Army field manuals.

An analysis of existing personnel levels, their skills, and the equipment available in an engineer construction company for use in the rapid repair of runways will be made. Recommendations for modifications to the existing situation so as to accomplish the repair mission will be made. Guidance and expertise in the procurement of needed materials and equipment will be provided. Military personnel will be trained in the use of the material and equipment for rapid repair. Training will include repairing a number of small craters. After training, a demonstration repair consisting of repairing one large crater formed by a 750-lb bomb exploding below the surface and some smaller craters will be performed in a 4-hour time interval. Laboratory and field support to accomplish the training, repair, and documentation of materials behavior will be provided. Information needed for preparation of a field manual on the repair of runways using regulated-set cement will be compiled and a manual written.

ADDENDA: Supporting Agency Address is: OCE Waterways Experiment Station, US Army Engineer Corps, P.O. Box 631, Vicksburg, MS 39180

SUPPORTED BY U.S. Dept. of Defense - Army

1.0011, ALL-WEATHER ROADS, AIRFIELDS, AND HELIPORT SYSTEMS
S.G. TUCKER, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0K5550)

The construction, repair, and rehabilitation of forward areas for the support of combat operations that require excavation, backfill, drainage, and compaction of soil areas are currently impossible during wet, rainy weather for prolonged periods of time. Materials capable of rapid emplacement by mechanical and/or hand-placement methods which provide uninterrupted movements of combat and support forces are needed to ensure the mobility and flexibility of field armies during adverse weather conditions.

Initially, a study of saturated in-situ confined and unconfined soils will be undertaken to identify the performance to be expected when exposed to various types of military traffic. Then a laboratory study will be conducted on selected soils by varying the degree of saturation which may be encountered in field operations. Physical characteristics determined by laboratory evaluations will be used as guides for the selection of waterproofing, drying, bonding, consolidating, and reinforcing wet weather construction materials. The most promising materials will be selected for evaluation in the field.

ADDENDA: Supporting Agency Address is: OCE Waterways Experiment Station, P.O. Box 631, Vicksburg, MS 39180

SUPPORTED BY U.S. Dept. of Defense - Army

1.0012, CONTROL OF DRIFTING SNOW ON FAA INSTRUMENT LANDING SYSTEMS FACILITIES AT BARROW AND DEADHORSE, ALASKA

UNKNOWN, U.S. Army, Cold Reg. Res. & Engin. Lab., *Hanover, New Hampshire* 03755 (FA59002; FA76NA-AP-1)

The U.S. Army Cold Regions Research and Engineering Laboratory (ACRREL) shall: 1. Conduct on-site surveys at two FAA ILS Sites; 2. Conduct laboratory tests using hydraulic models for snow drift control; 3. Furnish a final report which will outline procedures for eliminating or minimizing snow drifts; 4. Observe the following restrictions in order to preclude interference with antenna systems and airport runways: (a) no fences or barriers shall be allowed in the vicinity of the antenna near fields; and (b) solutions found shall not alter runway conditions or cause drifting in other critical areas or be responsible for creating other unfavorable conditions.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

1.0013, WIND-TUNNEL STUDIES OF AERO-OPTICAL INTERACTIONS

T.F. JERRICK, U.S. Air Force, Weapons Laboratory, *Albuquerque, New Mexico* 87117 (DF184310)

The objective of this effort is to gain an understanding of the interaction between an optical beam and an aerodynamic flow field such as exists around an aircraft. The degradation of an optical beam propagating through the atmosphere from an aircraft arises primarily from the flow field around the aircraft, up to quite long ranges. A detailed understanding of these effects is lacking. Moreover, what experimental data exists shows a lack of correlation between wind-tunnel model results and measurements made in flight. This effort aims both to develop a thorough theoretical and experimental understanding of the aero-optical interaction, and to determine scaling laws between wind- tunnel and in-flight results.

The approach to be taken in this effort is to first perform detailed and exhaustive studies of the aero-optical interaction using simple wind-tunnel models. The aerodynamic parameter characterizing the flow around the models will be measured in detail, and correlated with the observed degradation of a laser beam propagating across the flow. The aerodynamic parameters to be investigated include the thickness of the turbulent boundary layer, the scale size of turbulence, separated and shear layer flow, oblique shock waves, and steady-state (potential flow) density gradients. Optical measurements will include modulation transfer function, point spread function, intensity scintillation, angle-of-arrival fluctuation, and induced steady-state aberrations. The experimental efforts will be conducted as a joint Air Force-NASA effort at the NASA-Ames Research Center. Concurrently, theoretical studies will be undertaken to determine the scaling of the aero-optical effects between wind-tunnel models, experiments, and aircraft flight experiments. The wind-tunnel measurements described above will serve as input to this theoretical study. Additional experimental input and verification will come from airborne propagation experiments undertaken by the AFWL in a separate program. Finally, scale models of aircraft turrets will be investigated in wind tunnels to both verify the theoretical analyses developed and to optimize optically the turret design. The program is primarily in-house. Contractor support will be required for design and construction of wind-tunnel models.

ADDENDA: Supporting Agency Address is: AF Weapons Laboratory ALO, Kirtland AFB, NM 87117

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0014, EVALUATION OF ENGINEERING SCIENCES RESEARCH RELEVANT TO CURRENT AND PROJECTED AIR FORCE INTERESTS

F. ROTHSCHILD, Polytechnic Inst. of New York, Graduate School, *Brooklyn, New York* 11201 (DF001080; F44620-72-C-0005)

Air Force function - aerospace vehicles, weaponry, air-breathing propulsion, rocket propulsion. Deficiency/opportunity - a highly selective procedure is necessary to assure the program of high-quality fundamental research necessary for advancing the frontiers of science of high relevance to the Air Force. In-depth expert research evaluation and advice on basic research pertinent to the areas of mechanics and energy conversion will be made available to AFOSR to supplement the in-house expertise of the Directorate of Aerospace Sciences in the formulation of the mechanics and energy conversion programs. Objective - to provide independent, critical reviews by highly qualified professionals of the AFOSR research plans and programs in mechanics and energy conversion and of the individual proposals and research studies which are submitted to AFOSR. How contributes - provides independent evaluation of AFOSR research programs, as well as advice pertaining to the preservation of the required high degree of scientific quality of the research.

The investigator will select, screen, and assemble experts to serve individually, and as members of panels, to evaluate AFOSR/NA research projects and programs, to provide special reports to AFOSR on individual research proposals and on state of knowledge in areas of interest to AFOSR. Recommendations concerning content and management of AFOSR research programs will be included in the scope of the evaluations.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0015, TURBINE ENGINE EXHAUST NOZZLE PERFORMANCE INVESTIGATION

D.A. DUSA, General Electric Company, *Cincinnati, Ohio* 45215 (DF455850; F33615-73-C-2037)

The objective of this program is to assess the potential for use of various plug nozzle types in advanced integrated propulsion systems of the future. In particular, the contractor will define external and internal flow characteristics and performance of promising plug nozzle designs installed in afterbodies of advanced design.

Phase I, design studies of various plug nozzle types and afterbody shapes for use in advanced technology engines. Phase II, fabrication and testing of the most promising of these configurations. Phase III, definition of follow-on full simulation testing program.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory TBA, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0016, SOUND TRANSMISSION THROUGH SUPERSONIC JETS

I. GREBER, Case Western Reserve Univ., School of Engineering, *Cleveland, Ohio* 44106 (DF040030; AF-AFOSR-2750-75)

The Air Force is using, and will continue to use in the foreseeable future, high-speed jet aircraft. The principal means of propulsion of such aircraft is the turbojet. An undesirable by-product of these engines is the generation of noise which causes such adverse effects as degradation in human performance, reduced reliability of structural and equipment subsystems, and increased maintenance costs. Unlike civilian aircraft, the exhaust from Air Force turbojets can be supersonic. The design of engine parts and vehicle subsystems and soundproofing material to alleviate noise effects requires accurate definition of the intensity, occurrence and propagation of this noise. In order to partially fulfill this requirement an experimental study of the problem of supersonic jet noise is being made. The main emphasis in this study will be on the transmission of sound from within a supersonic jet to the surroundings. The primary quantity to be measured will be the spatial distribution of sound pressure, as a function of frequency, in the field outside the jet due to a simple sound source within the jet. Although the major effort of this program will be experimental, consideration will be given to a theoretical description of the phenomenon.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0017, OXYGEN SENSORS, REGULATORS AND SIMULATORS

J.P. ALLEN, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136610)

Aircraft oxygen systems utilize breathing regulators which deliver oxygen in the normal mode in excess of physiological requirements. A precision regulator would save oxygen and reduce the size and logistics associated with the oxygen system. Development of the regulator requires an assessment of performance under simulated altitude condtions. No simulated capability currently exists. A lack of sufficient oxygen, on the other hand, may produce hypoxia (oxygen insufficiency) in crew members, thus jeopardizing safety and performance. Hypoxia, however, must be readily detectable before crew performance deteriorates. A sensor which rapidly indicates oxygen concentration levels on a breath- by-breath basis would satisfy this need. Sensor output must also be evaluated for applicability as feedback to dilution control regulators to provide automatic correction of a hypoxia condition. Summarily, this effort will provide a modified manned breathing simulator and altitude simulation facility necessary for regulator performance evaluation, and an oxygen concentration sensor acting as a hypoxia warning device.

Modification of a man breathing simulator to achieve altitude characteristics will be completed. The modified simulator will be evaluated in an existing altitude chamber to determine the accuracy of simulation. Existing and developmental precision breathing regulators will be installed in the simulator and evaluated for altitude performance. Simulator modifications will be coordinated with operational procedures required in evaluation of current and new designs of breathing regulators. Oxygen sensors currently designed for use in hypoxia warning devices will be analyzed as to response time and operating life. Final design prototypes will be evaluated using the man breathing simulator under simulated altitudes to verify adequacy in hypoxia warning.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FEE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0018, DESIGN AND ANALYSIS OF ADVANCED STRATEGIC AND TACTICAL MILITARY AIRCRAFT EXHAUST NOZZLE SYSTEMS

D.L. BOWERS, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF132000)

The broad problem area of advanced turbojet/turbofan powered military tactical and strategic aircraft is the losses in range and performance attributed to airframe/exhaust nozzle flow interactions. The problems associated with the exhaust system integration have become quite complex for aircraft required to perform efficiently both subsonically and supersonically. The objective of this study is to develop new analytical and design techniques, and to improve available analytical methods that will predict the installed performance of jet exhaust nozzles on advanced strategic and tactical military aircraft.

Improve the calculation of installed exhaust nozzle performance of advanced military strategic and tactical aircraft by improving current and developing new analytical techniques for calculating nozzle internal and external flow fields. Existing experimental data and additional experimental data generated in the AFFDL trisonic gasdynamics facility, AEDC PWT facilities, and NASA facilities will be utilized to develop empirical criteria for exhaust nozzle design.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FXMB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0019, AERODYNAMIC ANALYSIS ON CAVITIES, 2-D AND AXISYMMETRIC BODIES

W. CALARESE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF138570)

A significant problem area of high-performance military tactical and strategic aircraft are the range and performance losses due to airframe-exhaust nozzle flow interactions. These losses are more significant in the transonic regime where nonlinear effects produce drag forces beyond tolerable limits. High drag and turbulence are also produced by open port turrets necessary for the use of such equipment as telescopes. The objective of this investigation is to develop a theoretical approach capable of analyzing the transonic and supersonic flow field over 2-D airfoils and bodies of revolution including jet plume, Reynolds number effects, shock-boundary layer interactions, boattail injection, and viscous mixing in separated regions, to provide quiet environment behind an open port, to minimize optical distortion and attenuation along a line of sight through the open port to some external point, to study laser exhaust flow and to obtain an overall drag reduction.

Numerical techniques, i.e., relaxation and/or time dependent, will be used to solve the transonic inviscid flow field. Boundary layer properties, jet plume effects, and mixing will be calculated with appropriate methods and incorporated in the solution. A computer program will be developed. Experiments will be performed in-house in the 2 ft tunnel over an already existing ogive-cylinder model with a metric porous boattail which allows mass injection, and with a plume simulator. Jet plume and Reynolds number effects on boattail and base drag will be checked and shock location and shock-boundary layer interaction will be analyzed as functions of boattail mass injection. Experimental wind tunnel tests will be conducted to achieve afterbody drag reduction by mass injection and to determine the magnitude and frequency of flow directions and various cavity geometries. Porous boattails, fairings, spikes, deflectors, and spoilers will be used to improve the external flow pattern and reduce drag and density gradients throughout the speed regimes.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FXMF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0020, CONCURRENT MULTI-TEST CAPABILITY FOR THE AFFDL AEROSPACE STRUCTURES TEST FACILITY

R.L. DENISON, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF130700)

Mission requirements of present and near-future military aircraft often dictate that airframe structures be designed to operate near the upper limits of their design capabilities which, in turn, causes a great increase in dependence on testing. This increased test dependency has impacted the workload on the AFFDL Aerospace Structures Test Facility (ASTF) to the extent that during the time period of FY 74 and beyond it must be able to conduct multiple real-time test programs concurrently and with minimal increase in staffing. The objective of this effort is to develop the operational capability to more efficiently measure structural responses, process data, and support simulated environmental control functions so as to enable the ASTF to conduct, simultaneously, as many as six test programs.

A necessary first step for achieving the objective is the replacement of the ASTF data system's batch-oriented second-generation Control Data Corp. 1604B computer with a multi-task real-time system. Owned and projected procurement of Digital Equipment Corp. PDP-11 minicomputers will be integrated with the 1604B replacement to form a hierarchical system. The PDP-11's will be dedicated to specific single test tasks, and the 1604B replacement will be shared among all tasks. Overall hardware/software configurations, as well as any necessary special interfaces, will be evaulated (or designed) as required.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FBT, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0021, AIRFLOW EFFECTS ON COMBAT AIRCRAFT FIRES

C.C. GEBHARD, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF130430)

Many fuel fires in combat aircraft which are induced by hostile gunfire continue to burn due to aerodynamic pumping of surrounding ambient air. The combination of structural damage from projectile impact coupled with hydraulic ram often opens up structure, allowing expansion of fuel fires and ignition of fuel by hot engine parts. Altitude changes often do not extinguish such fires; such fires often result in aircraft loss. A better understanding of airflow on such fires is required to eliminate this hazard. The objective of this program is to gain a better understanding of these phenomena and to establish design criteria to assist designers in reducing this hazard.

Review pertinent existing data to determine areas where additional information is required. Design and conduct tests to supply additional data in areas of aircraft wing and fuselage fuel tanks and engine inlets. Analyze all data and formualte design criteria to aid aircraft fuel system designers in designing more survivable aircraft fuel systems. Tests to be conducted in-house to make maximum use of existing facilities and hardware.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FES, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0022, PRELIMINARY DESIGN OF ADVANCED WING STRUCTURE

A. GONSISKA, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF131620)

The rising acquisition and maintenance costs of advanced aircraft structures present a formidable obstacle to the procurement and operation of future Air Force weapon systems. Development of lightweight, high-integrity, low-cost airframe structures is urgently required to reverse the current trend of materials and labor cost increases. This effort is to innovatively exploit the latest developments in the field of structures technology to reduce, by at least 10 percent, the costs of advanced USAF strategic bomber wing structures while maintaining or increasing current levels of efficiency and integrity.

A swing wing aircraft (B-1) will be used as the baseline for a preliminary design study to develop innovative structural concepts for advanced system form, fit and function requirements. New structural arrangements, materials and fabrication techniques will be exploited and integrated to establish potential cost and weight reductions.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FBSA, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0023, APPLICATION OF AEROELASTIC TAILORING METHODS FOR ADVANCED COMPOSITE STRUCTURES

K.E. GRIFFIN, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF133310)

Favorable aeroelastic deformation could provide improved fighter performance in terms of increased lift in maneuvers and drag reduction through reduced angle of attack for a sustained maneuver. For moderate to high aspect ratio wings, control of aeroelastic deformation could provide maneuver load relief or minimum drag. In the application of high-stiffness, low-weight advanced filamentary composite materials (boron, graphite, etc.), the capability exists to tailor the stiffness distribution, both bending and torsion. This will permit achieving a desirable aeroclastic deformation while at the same time providing adequate stiffness for prevention of flutter in thin wings which would not be achievable in conventional metal designs. The specific objective of this project is to become familiar with and improve a computer procedure (TSO) which produces a minimum-weight and/or best-performance composite wing design that meets required stiffness and strength criteria and has desirable aeroelastic deformation. The computer program (TSO) will be applied to wing configurations to make a detailed examination of possible aeroelastic tailoring approaches.

A three-part program will be conducted, first to become familiar with all phases of the design program, second to update the TSO computer program, and third to apply tailoring techniques to an advanced airframe design to observe the extent of both beneficial and detrimental performance changes. The first part will use as the baseline design the FDL-23 airframe for which the laboratory has ample unclassified design and wind-tunnel information. Part II will make the necessary changes in TSO identified in Part I. Part III will apply the aeroelastic tailoring procedure to an advanced airframe (either fighter or RPV) to develop relative performance impacts for evaluation.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FBRC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0024, MOMENTUM AND ENERGY EXCHANGE IN MULTICOMPONENT EJECTOR PUMPING

S.H. HASINGER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136510)

Current high-energy chemical laser systems are required to operate with very low laser cavity pressures and at the same time exhaust to ambient conditions. The pressure recovery required to accomplish this cannot be realized without some sort of external pumping system. At the present there is a lack of a flight-weight pumping system capable of meeting the requirements of an operational chemical laser. The objective of this research is to determine and demonstrate the feasibility of using gas-driven ejector pumping concepts to attain the high pressure recovery required by chemical laser systems. Ejector pumping concepts have the potential of providing a compact, lightweight pump for use with an airborne chemical laser system.

The basic aerodynamics of the relevant flow processes will be investigated experimentally and analytically to determine the applicability of these concepts for the chemical laser pumping application, and to define the ranges of possible operation. Additionally, an analysis of the overall pumping system configuration will be made to define energy, volume, and weight requirements for the system, and an attempt will be made to optimize the pumping cycles for minimum system weight. In order to do this it will be necessary to maximize the pressure recovery capability for a given mass flow of the ejector pumping fluid. It is anticipated that areas of research will include nozzle design, nozzle placement, mixing-section configuration, and diffuser configuration.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FXEC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0025, DESIGN TECHNIQUES TO PREDICT AND MINIMIZE INTERFERENCE HEATING

J.R. HAYES, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF134990)

Interference heat transfer is the main thermal problem of supersonic missiles and aircraft. Aerodynamic control surfaces and their actuators are especially critical as it is these which generally cause and are subjected to the increased heating rates. The objective of this study is to integrate the results of previous and current in-house and contract work elements into a coherent design technique. Data trends will be generalized through the development of an analytical flow model. The design report will provide confidence in the selection of control surfaces and materials, thus eliminating costly ground verification tests and insuring maximum vehicle performance.

A design report and computer technique will be prepared which will analytically extend and generalize results from previous work elements. Minor experimentation will be completed in order to fully understand data trends. The design report will conclude a significant portion of exploratory development work and suggest problem areas which still exist for future research activity.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FXGC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0026, AUTOMATIC/MANUAL TAKEOFF AND LANDING FOR LARGE MILITARY AIRCRAFT

T. IMRICH, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF127390)

The ability of the Air Force to agilely and effectively respond to military needs world-wide is severely restricted under zero-visibility weather conditions. The objective of this task is to develop improved mission capability for all-weather operations through flight control/display research for large military aircraft. Included in this research are efforts to: (1) improve automatic and manual capability for takeoff approach, flare, rollout and go-around in weather conditions down to 150 ft RVR. Specific tasks under this effort include: (a) planning, coordinating and participating in test missions, (b) analysis of test data, (2) development of flight systems and procedures for high- density, noise-sensitive terminal area operations with minimum pilot workload. Specific tasks under this effort include: (a) continuation of development of R-

NAV capability for the project aircraft, (b) development of improved cockpit input/output devices, (c) development of a CRT navigation display capability, (d) planning, coordination, test participation, and data analysis for terminal area approach profile investigation.

The control/display configurations are to be developed and tested on a KC-135 aircraft.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FGT, Wright-Patterson AFB, ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0027, AERODYNAMIC PREDICTIONS FOR ANALYSIS AND DESIGN

J.K. JOHNSON, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF131990)

Aerodynamic prediction methods for analysis and design of advanced technology, military aircraft are required. The objective is to obtain for in-house use both quick turn-around programs (level I) and more detailed, time-consuming programs (level II). Programs for handling arbitrary configurations, including advanced technology concepts, through the subsonic, transonic, and supersonic flight regimes will be obtained. These programs are necessary to prevent technological deficiencies and reduce developmental costs.

Existing in-house level I programs will be extended to handle advanced technology concepts. Capabilities of existing in-house level II programs will be fully explored. Additional level II requirements will be identified, existing programs obtained/extended where possible, and new programs developed.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FXM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0028, STABILITY AND CONTROL FLIGHT RESEARCH ANALYSIS AND DATA CORRELATION

S.F. LASH, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF133450)

At present the level of accuracy is not well known of the present analytical methods (theoretical, semiempirical and wind-tunnel test) used in the development of an aircraft for predicting its full-scale flight characteristics. This knowledge is required to better design future weapons systems. The objective of this program is to determine the degree of correlation existing in the area of stability, control and handling characteristics as extracted from flight data with the characteristics as predicted using present state-of-the-art analytical methods and test procedures.

The approach to this problem is to extract a consistent and repeatable set of stability derivatives and handling-qualities parameters from flight-test data on a variable-sweep aircraft. These data will be correlated with predicted characteristics as derived using (1) analysis incorporating wind-tunnel data from models having both rigid and aeroelastic wings and (2) from analytical methods employing theoretical and/or semiempirical estimates.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FGC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0029, VIBRATION AND ACOUSTIC MEASUREMENTS ON THE X-24B FLIGHT TEST VEHICLE

V.R. MILLER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF134670)

At the present time data does not exist which would allow the designer of military lifting reentry vehicles to determine the vehicle's expected environment with respect to vibration, fatigue, buffet, pseudo- noise, and control surface response. The objective of this program is to provide the needed environmental information to reduce the design margins on future military systems resulting from existing dynamic uncertainties.

Accelerometers and microphones were installed on an X-24B flight- test vehicle to measure the vibration and acoustic environment in selected areas. The resulting flight data will be reduced and analyzed and pseudo-noise spectra will be related to flight parameters such as dynamic pressure 'Q' and Mach number. Prediction methods will result for ready use by designers.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FBED, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0030, CONTROL SYSTEM INDUCED AEROELASTIC INSTABILITIES

T.E. NOLL, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF134660)

Aircraft with active control systems can encounter instabilities which result from the interaction of the control system with the aeroelastic response if adequate control compensation is not provided. The objective of this effort is to substantiate analyses which account for the control system interaction. This effort will establish the confidence and reliability of AFFDL in-house analysis procedures. The ultimate payoff will be a reliable method for use in the design stage for predicting and preventing control induced aeroelastic instabilities, thus reducing cost and increasing flight safety for a new aircraft.

Frequency and time domain computer programs developed under AFFDL Contract F33615-73-C-3063 will be applied to an advanced fighter aircraft with an active control system to predict control induced aeroelastic instabilities. These analyses will involve the interaction of the structural response, the airloads, and the control system response. A final technical report will be prepared.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FBRC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0031, DEVELOPMENT OF HEATED-AIRFRAME DESIGN CRITERIA FOR STRATEGIC AND TACTICAL AIRCRAFT

D.B. PAUL, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF129190)

Strategic and tactical aircraft with supersonic to hypersonic speed capability need detailed design requirements in military specifications and adequate airframe load prediction techniques to account for the effects of aerodynamic heating upon flight vehicle airframes. Current military specifications (MIL-A-8860 series) do not delineate adequate requirements for airframe design under aerodynamic heating, and the AFSC design handbooks do not outline proper procedures to structurally account for heating effects. This effort will develop essential heated airframe design criteria and the associated load prediction techniques to account for the structural effects of aerodynamic heating on military aircraft.

Develop and refine in-house heated structure analysis techniques with emphasis on advanced heated airframes, but with possible application to other heated structures (such as radomes and propulsion systems). Establish, where necessary, computer programs to aid structural design engineers. Implement, where applicable, proven techniques into the AFSC design handbooks and the USAF structural design criteria specifications.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FBE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0032, IMPROVEMENTS IN DESIGNS OF STRUTS FOR FLOW DIAGNOSTIC PROBES USED TO SUPPORT HIGH-SPEED WEAPONS SYSTEMS TESTING IN ARC FACILITIES

E.B. PETERS, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF130250)

The performance of military flight vehicles is influenced by the shape and the flow patterns established over their surface. In defining the flow field over the vehicles in the arc-heated test facilities during flight simulation, it is essential that the flow field be disturbed as little as possible by the model support. Copper support struts have been developed in-house with an acceptable aerodynamic shape, with satisfactory cooling of the leading edge, that withstand the heating rates created by the model shock interaction. The major objectives are to have struts that are free

from physical distortion and coolant leaks, have a minimum cross section and have no local boiling of the coolant. The objective of this in-house work is to improve the technology for analyzing flow field of arc-heated high-temperature test facilities.

The experimental and theoretical thermal characteristics of the struts will be determined by conducting extensive realistic test in the AFFDL/FXN thermal laboratory by using sophisticated instrumentation to control the heating rates and the cooling water flow rates. Tests will be conducted to analyze the heat transfer, stresses, and probe response using the struts. After the initial test in the laboratory, the struts will be returned to the arc-heated high-temperature test facilities for further evaluation, and to determine the degree of improvement of data acquisition in the test facilities.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FXMC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0033, EVALUATION OF EXTERNAL STORE FLUTTER PREDICTION METHODS

S.J. POLLOCK, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF132600)

A significant amount of time and cost can be required to clear an aircraft for flutter when large numbers of different configurations of external stores must be carried. The objective of this effort is to evaluate various approaches being developed for flutter prediction of aircraft carrying external stores. A second objective is to investigate the possibility of external store flutter on the lightweight fighter and help define possible candidates for active flutter suppression. A reliable analytical procedure for conducting flutter safety evaluation of aircraft carrying external stores should significantly reduce time and cost required for flutter clearance.

Vibration and flutter calculations will be performed on the lightweight fighter with external stores initially with the FACES Program (AFFDL-TR-73-74). Results will be compared with contractor analytical and measured data to evaluate the FACES program. Next, the computer program based on the perturbation method (AFFDL-TR-72-114) which is currently being modified for CDC equipment by the University of Dayton, will be applied to the same configuration. A comparison of the two methods will be made to determine which procedure is most accurate and efficient.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FBRC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0034, DUCT ACOUSTICS RESEARCH

D.W. QUINN, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF138560)

To understand the dependence of sound levels within ducts upon such factors as duct geometry, sound-absorbing properties of the duct walls, type of sound source, and flow within the duct. Specifically, to develop new aero-acoustic models and solution techniques for general duct acoustics problems. This work will be a significant contribution to the AF Aero-propulsion Laboratory's efforts to reduce turbine engine noise levels. To quote RN-AFAPL-08-72-9, 'Current engine noise levels are hazardous to personnel and structures, detrimental to tactical operations and annoying to the general public.' Eventually we should be able to 'assess engine performance/noise trades' in the design of aircraft engines.

To realistically investigate sound attenuation in jet aircraft engines, ducts with variable cross sections need to be considered. A method of conformal mapping was developed by the principal investigator in FY-74/FY-75 to be used in conjunction with a finite-difference method for variable-area ducts and no flow. Currently, an integral equation/potential theoretic method is being developed as an alternate approach for the same problem. This should be completed and made a part of the literature in FY-76. Future work includes the derivation of a reasonable mathematical model which includes mean flow for variable area ducts. A finite-element method seems to be most appropriate for such a general problem. Preliminary results should be available in FY-76 with the work being completed in FY-76/FY-77. Later in FY-76, analytic methods are going to be included in an AFAPL evaluation package and the principal investigator of this work unit will be in close communication with the needs associated with such an undertaking.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FBRD, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0035, AIRCRAFT EQUIPMENT VIBRATION TEST CRITERIA

R.W. SEVY, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136640)

Aircraft equipment vibration test spectra, estimated by contemporary methods, are in many cases overly conservative in amplitude and unrepresentative in spectral form. In addition, aircraft stores criteria do not adequately address effects of mass distribution and rack sensitivity. These deficiencies result in inadequate design, excessive costs and unrealistic laboratory tests. To mitigate these penalties it is necessary in the case of equipment to develop test criteria that can be tailored to the specific mounting method, the location and to the aircraft class and operational category, and in the case of stores, to develop criteria which will satisfy mass distribution and rack requirements.

Develop and apply transfer functions that relate the source of vibratory energy to the interface and which take into account equipment and store mounting methods. Develop vibration test spectra whose programmed, sequential application to the equipment represents the significant vibration sources during each major flight condition, such as takeoff, climb, low-level dash, cruise, combat turns, etc. Results shall be used in formulation of revised test criteria for method 514, MIL-STD-810C.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FEE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0036, AERODYNAMIC ANALYSIS METHODS FOR FLIGHT VEHICLES

D.E. SHEREDA, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF138390)

Determination of the aerodynamic characteristics of high-speed vehicles must be made early in the design development of such systems. Experimental test programs are expensive and limited in scope whereas numerical methods, while not having these problems, are accurate only within narrow limits of shape and speed. This effort seeks to expand these limits for vehicles suitable for high-speed flight, both aircraft and missiles. Numerical methods will be developed and evaluated for improving accuracy of analysis techniques.

Recently developed analysis methods will be exercised, evaluated and improved to provide increased analysis capability. New methods will be developed in areas of unsatisfactory correlations with test and flight data. An experimental program to provide data on high-performance aircraft will be conducted in-house. Comparisons of these data with latest analysis methods will provide further insight into shortcomings of updated numerical techniques.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FXGB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0037, INVESTIGATION OF TACTICAL FIGHTER FOREBODY FLOW FIELD AND INTEGRATED INLET PERFORMANCE DATA

L.E. SURBER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF131210)

One of the critical problems in preliminary aircraft design is the deficiency of technology in the area of airframe-propulsion integration. This program seeks to provide a broader range of fundamental design criteria for supersonic external compression air inlets, thus providing the means to reduce development cost of future propulsion system installations. The objective of this pro-

gram is to provide the capability to design an aircraft air intake from the outset which will combine simplicity, high performance, and reliability to such a degree that the necessity for subsequent cycles of test and redesign will be significantly reduced or eliminated.

In-depth investigation of wind-tunnel data generated under F33657- 69-C-1209, F33615-72-C-1747, and F33615-72-C-1160 will be accomplished. This effort will include examination of forebody flow fields, inlet diverter flow, inlet face total pressure distribution, duct total and static pressure distributions, compressor face pressure recovery and distortion, and inlet/airframe drag data. Both steady-state and dynamic data will be used to determine sources of flow distortion. Effects of inlet design variation on inlet-related drag will be examined. The associated effects of various inlet designs and installations will be used to suggest design improvements.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FXM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0038, CONTROL OF GROUND TEST FACILITIES FOR HIGH-SPEED FLIGHT SIMULATION

W.C. WELLS, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF132620)

High-speed flight vehicles are subjected to severe conditions during reentry into the earth's atmosphere. These reentry conditions can be simulated in ground test facilities. Ground test facilities for aerodynamic and thermodynamic simulation of high-speed flight conditions are subject to continually changing requirements. The objective of this work unit is to identify and alleviate technical deficiencies and improve system reliability and maintainability in the AFFDL ground test facilities. Technology, techniques and equipment will be developed for system automation, environmental protection, and structural and mechanical integrity. Improvement of ground test facilities makes possible their use in overcoming a broad spectrum of technical difficulties associated with high-speed flight.

The cost effectiveness of current high-pressure air, water, vacuum and refrigeration systems operation will be weighed against the effects of system automation or replacement. Systems will be automated or improved as required. The operating effectiveness, environmental effects and integrity of mechanical and structural systems will be studied and unsatisfactory conditions alleviated.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FXND, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0039, CREW ESCAPE MODULE RETROROCKET CONCEPT

M.C. WHITNEY, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF127230)

During emergency escape from military aircraft, the landing impact loads experienced by occupants of the escape module must be kept within human tolerances through attenuation systems. It is common to use air bladders with blowout plugs for this purpose. However, when the crew escape module is descending in high winds, the ensuing lateral velocities will diminish the air bladder's usefulness as an impact load attenuator. It is the objective of this program to design and demonstrate the application of a retrorocket as an impact load attenuator that will be much less sensitive to the effects of lateral velocities at impact and therefore provide a more reliable and effective crew escape module.

An analysis and design effort will provide the design of a suitable retrorocket which will then be fabricated and subjected to full-scale tests using a simulated B-1 crew module at El Centro, California.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FER, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0040, ILS SMOOTHING

M.J. WILSON, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF134840)

During an ILS approach with present equipment, the pilot has no way of determining when beam drift or bends have occurred. This system will augment the ILS beam with on-board inertial sensors. An additional benefit is that low-quality ILS beams could be used with lower weather mimima than presently authorized.

The modification to the present inertial system on board the AWLS C-141 is to be done by a contractor. Air Force will evaluate the benefits of the modification through flying approaches against various ILS beams in simulated and actual low-visibility weather.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FGT, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0041, X-24B GROWTH VERSION

W.P. ZIMA, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF129040)

The lack of sufficient flight research at speed between Mach 4 and 7 creates a technological deficiency which threatens the development of an adequate force structure during the next two decades. Definition of strategic and air-superiority vehicles of the future will necessitate the availability of basic aerodynamic/aerothermodynamic criteria on which to predicate the high-performance configurations. The growth version of the X-24B research vehicle will provide a low-cost/low-risk method of obtaining basic data directly applicable to these configurations. The specific objective of this effort is to complete the concept formulation activity necessary to support a joint USAF/NASA program for the design, manufacture and test of a derivative of the X- 24B research vehicle and thereby produce a viable low-cost test bed to explore the aerodynamic/aerothermodynamic phenomenon inherent in high- speed flight.

Analytical studies, empirical prediction techniques and computer synthesis programs will be utilized to formulate the initial aerodynamic configuration and define the aerodynamic, performance and thermal characteristics. In-house technical resources of both the USAF and NASA will be utilized to accomplish the above analyses to thereby provide a low-cost, cooperative approach to accomplishing the concept formulation phase of the Advanced Development Program. Wind-tunnel tests throughout the Mach number range will be conducted on an array of vehicle configurations around the X-24B double-delta, lifting body shape to establish the credibility of the selected configuration of the X-24B growth vehicle (i.e., X-24C). The practicability and impact of flying various experiments on this vehicle will be determined. Pursuant to accomplishing the concept formulation activities and formulating a technical base from which to launch the preliminary design aspects of an advanced development, the aerodynamic and aerothermodynamic constraints inherent in the selected X-24C configuration are being assessed. Additionally, emphasis is being placed on the verification of the low- cost structures/thermal protection system on which the concept is predicated and identification of subsystems to complement this overall vehicle design.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FXSA, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0042, AIRCRAFT/STORES HEATING

D. MATTHEWS, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF420868; F40600-75-C-0001)

To 1) correlate wind-tunnel and flight-test heating data on an external store, 2) obtain a computer solution to provide store temperature distribution for flight conditions, 3) conduct analysis.

1) Conduct experimental flight test at Edwards AFB using an F111, 2) conduct wind-tunnel measurements using thermographic phosphorus technique, 3) develop a correlation between flight-test and wind-tunnel results.

ADDENDA: Supporting Agency Address is: Arnold Engineering Development Center, Arnold AFS, TN 37389

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0043, PRODUCTION COST ANALYSIS OF RAMJET ENGINES

E. KOLTKO, Vought Aeronautics Company, *Dallas, Texas* 75222 (DF458040; F33615-76-C-2043)

The objective of this effort is to develop a method for obtaining the production costs of parts, sub-components, components, and sub- assemblies of ramjet engines.

The methodology will address fabrication techniques and will relate cost to production steps. A building-block approach will be used whereby costs of the various engine parts are additive to subcomponents, sub- components are additive to components, and so forth until total engine cost is obtained.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory RJA, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0044, INJECTION, ATOMIZATION, IGNITION, AND COMBUSTION OF LIQUID FUELS IN HIGH- SPEED AIR STREAMS

J.A. SCHETZ, Virginia Poly. Inst. & St. U., School of Engineering, *Blacksburg, Virginia* 24061 (DF029130; AF-AFOSR-2584-74)

AF function - advanced air-breathing engines, external burning systems, weapon delivery and defense, transport. Deficiency - insufficient fundamental understanding of the problems associated with high-speed combustion phenomena in advanced practical combustor systems and lack of realistic guidelines for predicting injector/mixing system and combustor/propulsion system performance and operational characteristics and selection of acceptable liquid fuels. Objective - to formulate realistic analytical models describing the detailed physical and chemical processes involved in advanced turbojet and ramjet combustor concepts and external burning systems. How work contributes - will provide improved understanding and realistic analytical modeling of injection, breakup, mixing, vaporization and ignition phenomena not now available and will contribute to establishing guidelines and criteria for choosing acceptable fuels and in design and development of practical injector mixing systems and combustors of advanced engines, e.g., turbojet main- and afterburner, dump-vortex burners, dual-mode scramjet, and external burning systems.

Penetration, breakup, atomization and vaporization and ignition of liquid jets injected across a high-speed air stream will be studied in subsonic, transonic and supersonic facilities at various Mach numbers, and including conditions associated with external burning and 'dump combustors.' Emphasis will be directed toward understanding the basic fracture mechanisms, vapor pressure effects on the atomization process and the influence of liquid accumulation on the surface on near-field ignition processes. Ignition and combustion processes on liquid surface layers in the region of the injection port will be studied in an electrically heated air facility with a combustion fired afterburner. Flow fields, atomization, vaporization and diffusion rate, and ignition and combustion details will be determined optically employing spark schlieren, high-speed movies (up to 40,000 pic/sec) and infrared photography. Analytical descriptions of the phenomena will be developed.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0045, HT 76-9 METHOD FOR PREDICTING HELICOPTER AUTOROTATIONAL CAPABILITIES

L.F. ELLINGTON, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0D4027)

To develop direct relationships for predicting the variations in airfoil characteristics from a given baseline airfoil which are necessary to give the corresponding desired changes in aircraft performance in the areas of high-speed forward flight, agility, and load factor capability.

A baseline aircraft of the attack helicopter type and a baseline airfoil will be selected. The baseline airfoil characteristics will be varied one at a time, and C-81 will be used to determine the change in aircraft performance resulting from each airfoil variation. Finally, quantitative relationships between the changes in airfoil characteristics and aircraft performance will be derived from these analytical results in each of the three areas studied.

ADDENDA: Supporting Agency Address is: AVSCOM Air Mobility R&D Lab, Eustis Directorate, Ft. Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0046, HT AM 75-5 - ANALYSIS OF ROTOR PERFORMANCE DEGRADATION DUE TO MANUFACTURING TOLERANCES

F.A. RAITCH, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0D3958)

To investigate helicopter rotor blade airfoil profile imperfections due to typical manufacturing tolerances, and the effects of these imperfections on rotor aerodynamic performance, especially when using an advanced sophisticated airfoil.

Seven different airfoils are analyzed using the NASA/Lockheed/North Carolina State University program to yield 2D lift, drag and pitching moment, in both clean, ideal profiles and with selected profile imperfections imposed, reflecting conventional manufacturing tolerances.

ADDENDA: Supporting Agency Address is: AVSCOM Air Mobility R & D Laboratory, Eustis Directorate, Ft. Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense - Army

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, SYNCHRONOUS ALTITUDE ATLAS

E.C. WHIPPLE, Univ. of California, Graduate School, *San Diego, California* 92037 (DF247760; F19628-76-C-0214)

AF function - AF satellite systems operate at synchronous altitudes where charging occurs and this in turn produces systems anomalies and degradation. Deficiency - the plasma environment responsible for spacecraft charging is not well understood. Objective - to develop an environmental specification of the geosynchronous plasma and field environment. How research contributes - plasma data from ATS-5 and 6 satellites will provide an environmental specification of the operating environment for AF synchronous satellites. The data will be used to typify the geosynchronous plasma environment's characteristics such that satellite charging mechanisms may be understood.

The University of California at San Diego will perform statistical analyses of the geosynchronous plasma parameters and their relation to charging events. An environmental data atlas based on ATS-5 and 6 data will be prepared to include plasma parameters typifying quiet and disturbed conditions. The atlas will serve as the basis for a geosynchronous environmental specification.

Addenda: supporting agency address is: af geophysics laboratory ph l g hanscom afb, bedford, mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

2.0002, SOLAR EUV SPECTROPHOTOMETER FOR A-E SATELLITES

J.L. BUCKLEY, Ball Brothers Research Corp., *Boulder, Colorado* 80301 (DF277510; F19628-72-C-0115)

AF function - vehicle tracking during flight and reentry, trajectory prediction, communication systems. Deficiency - insufficient data to allow accurate modelling of the average composition and structure of the upper atmosphere and of the ionosphere, and to predict the response of the atmosphere and ionosphere to temporal variations in the solar input. Objective - evaluate the contribution of solar radiation in the 140 to 1850 Angstrom re-

gion to the establishment of the composition and thermally determined structure of the upper atmosphere. Monitor the temporal variation of the incident solar radiation and relate such variations to corresponding changes in composition, density and structure of the atmosphere. How research contributes - by the design and development of precise, stable spectrophotometric instrumentation which is compatible with AE spacecraft interfaces and with the high-altitude environment where the measurements are to be made. By selection of detectors, filters and optical components, to guarantee precise, sensitive and long-term operation for the production of accurate and continuous spectral data.

Consistent with the spectrophotometric requirements for the UV instrumentation and the goals of the atmosphere Explorer missions, the contractor is responsible for the design of a flight package containing twenty-four monochromators, half of which are capable of scanning the wavelength range from 140-1850 Angstroms, the remaining half precisely and permanently set to twelve selected wavelength positions. The instrumental spectral resolution must be adequate for the aeronomical purpose of determining the thermospheric composition in terms of number densities of atomic and molecular oxygen and nitrogen. The contractor is to select optimum optical and electronic components as established by laboratory measurements and to provide first-order data on overall instrument calibration.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory LK L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

2.0003, SPACECRAFT CHARGING NUMERICAL THEORY

A.G. RUBIN, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF246180)

AF function - AF satellite systems operate at synchronous altitudes where charging can occur due to natural causes and may give rise to effects deleterious to the systems. Deficiency - the plasma physics interactions responsible for spececraft charging are not well understood at present and it is necessary to develop approximate models in order to obtain this understanding. Objective FY76 - develop computer code which describes the effect of energetic particle fluxes on the spacecraft charging process for conditions of spacecraft at synchronous altitude. Simulate ambient plasma as well as particle streams and secondary electrons and photoelectrons. How research contributes - this research will apply the powerful techniques of numerical simulation of plasma to the systems problem of satellite blackout due to charging and breakdown. These techniques can handle analytically intractable problems involving ambient plasma beams, secondary effects, and the effects of plasma instabilities.

The method of computer simulation of plasmas is applied. The motion of several thousand particles in the field of the spacecraft and their self-consistent field is followed. Computer codes are developed for this purpose. One such code has been extensively checked against analytical results. The code will be extended as expeditiously as possible to higher dimensionality, to include more realistic spacecraft configurations and surface properties and to more detailed treatment of secondary and photo-electron effects and for the inclusion of ion and electron gun effects as well. These studies will be supplemented by analytical treatment wherever possible.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory PH L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

2.0004, SPACE RADIATION EFFECTS ON INSULATORS USED IN ARTIFICIAL EARTH SATELLITES

J.A. WALL, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF246480)

AF function - communications. Deficiency - communications satellites (DSCS) have displayed erratic electronic behavior soon after being placed in orbit. It has been determined that at least some of the observed malfunctions could be due to electrical breakdown in insulating materials caused by the effect of electrons present in the region of satellite orbits. Objective - the objective of this work is to provide fundamental information on the effects of electrons, with energies corresponding to those encountered in the orbital region of the satellites, on insulating materials used in communications satellites. How research contributes - the information to be obtained will make possible improved satellite designs that minimize malfunctions due to space-radiation-induced electrical breakdown.

There are three electron-insulator interaction phenomena relating to electrical breakdown that will be investigated. These phenomena are induced conductivity, secondary electron emission, and injected charge distribution. Literature searches will be performed in each of these areas to determine the current availability of data and its relevance to the satellite charging problem. Where data is needed, experiments will be performed to obtain the required information. These experiments will consist basically of irradiating the insulating materials with electrons of appropriate energies in a clean, oil-free vacuum and measuring the induced conductivity and secondary electron emission. Injected charge distribution will be determined theoretically. The information generated by these investigations will be combined to select and test insulator-conductor combinations that will minimize the probability of space-radiation-induced electrical breakdown.

ADDENDA: Supporting Agency Address is: AF Cambridge Research Laboratories LQ, L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

2.0005, CONDUCT RESEARCH TO DESIGN, DEVELOP AND CONSTRUCT ENERGETIC PARTICLE DETECTION INSTRUMENTATION FOR SPACE FLIGHT

M.P. HAGAN, Emmanuel College, Graduate School, *Boston, Massachusetts* 02115 (DF266620; F19628-76-C-0039)

AF function - communications and surveillance. Deficiency - inability to predict solar particle effects on atmospheric and ionospheric environmental conditions. Objective - this is a research effort directed toward the design, development and construction of energetic particle detection instrumentation for satellite flight. Design instruments to measure energetic particle fluxes, discriminate species (electrons, protons and/or ions), and perform energy analysis. Instrumentation must be capable of discovering new scientific knowledge concerning the near-earth space energetic particle environment and be compatible with available Air Force satellite rides. The effort will cover the whole spectrum from design through construction and integration into the host satellite vehicle. Some adjustments in design may be required during integration to account for design discrepancies in the host vehicle. This re-design may have to be performed on extremely tight time schedules and, hence, personnel will have to be present during integration. How research contributes - provides instrumentation for detection and identification of energetic particles in space.

State-of-the-art instrumentation is developed and matched to available satellite rides with limited notice as to required sensitivities, data rates and limited power allotments. Instrumentation must be adapted to current research needs based on past experience and available electronic components. New devices such as position-sensitive detectors, micro-processors and magnetic materials must be integrated into current designs to obtain maximum spatial, angular and energy resolution consistent with reliability and delivery schedules. Instrumentation must be integrated into satellite payloads and adjustments and repairs made as required. Reports on all aspects of the instrumentation and data formats are prepared for utilization and interpretation in analysis of final data. Personnel remain available up to final launch for recalibration and repairs and assist in evaluation of data during launch and post-launch periods.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory PH L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

2.0006, SPACECRAFT CHARGE MODELING

L.W. PARKER, Lee W. Parker Incorporated, *Concord, Massachusetts* (DF246820; F19628-76-C-0248)

AF function - space systems survivability. Deficiency - inadequate knowledge of the interaction between the energetic particle environment at synchronous orbit altitudes and the potential field of a charged satellite is detrimental to the design of future

space systems. Objective - a theoretical investigation of the interaction between a high-temperature plasma and the potential distribution that exists in the vicinity of a charged satellite. How research contributes - the complexity and sophistication of present and future defense satellite systems has resulted in a greater susceptibility of these systems to environmental disturbances. Rapid changes in the fluxes of energetic plasma particles incident on a highly charged satellite can induce large transient currents which pose a threat to satellite components. Understanding the potential field of a spacecraft and identification of the conditions that yield the damaging transient currents are critical to future satellite design.

Computer techniques and models are developed to simulate the interaction of idealized spacecraft sheaths and an energetic plasma environment. Particle trajectories through the plasma sheath are studied in order to understand the interaction between the satellite potential field and the ambient plasma. Working in cylindrical coordinates, various combinations of satellite surface properties are modeled and the relative effects of these combinations are analyzed to determine the ultimate potential configuration.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory PH L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

2.0007, DEVELOPMENT OF A MANUAL EVA GUIDANCE PROCEDURE

W.T. FOWLER, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Astronauts on Extravehicular Activity (EVA) in the future will not be physically connected to the space shuttle. They will manuever about using a manned maneuvering unit (MNU). When the astronaut moves from point to point in space, he must take into consideration the laws of dynamics and orbited mechanics in order to fly the most efficient path from point to point. As a backup to the primary guidance system, manual procedures are being developed to allow the astronaut to return to the space shuttle without aid from the shuttle. These procedures are being kept as simple as possible so that they will be viable as backup procedures.

SUPPORTED BY University of Texas

2.0008, MILLIMETER RADIATION FROM ATMOSPHERIC GASES

A.W. STRAITON, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

DESCRIPTION: The object of this research is to examine theoretically the radiation which would be received at a satellite from the resonant radiation of water vapor, oxygen and ozone.

The approach used is that of selecting a model of the amount, temperature and pressure of the gas under consideration as a function of elevation. Using this model, the absorption and reradiation as a function of elevation is calculated using the Van Vleck-Weisskopf equations.

By integrating the radiation which would be received in space from each parcel of the gas by the loss caused by the intervening molecules, the expected antenna temperature at a satellite can be established.

When the upper atmosphere is observed at an angle near tangent to earth, the antenna temperature is very sensitive to the angle at which it is observed. By determining both the intensity and width of the lines of water vapor, oxygen and ozone as a function of the angle from the nadir, information may be obtained on the reliability of the model used, the variation with height and time of the distribution of the gases and the upper atmospheric temperatures.

From the results of this study, experiments on board the space shuttle planned for the 1980's may be suggested.

SUPPORTED BY University of Texas

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, SYNTHESIS OF SINGLE CRYSTALS OF THE TYPE II DIAMOND

G.C. KENNEDY, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (DF040800; AF-AFOSR-2814-75)

AF function - high-power lasers are being considered for many applications in future Air Force systems. Opportunity - one of the pacing problems in developing these lasers lies in the fact that windows absorb a portion of the energy and either distort the transmitted beam or fail due to differential thermal expansion. Recently diamonds have shown promise of satisfactory performance i.e. Low absorption, high heat conductivity, high strength. Objective - this research seeks to study the growth and chemical parameters necessary to produce large, high- quality diamond crystals. How work contributes - these crystals would allow greater power to be delivered on target and improve beam quality.

The chemistry pressure, temperature and time variables will be studied using a heated piston cylinder apparatus. Crystals are grown from 'seeds' in a carbon-saturated metal alloy.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0002, PROPERTIES OF NEW SUPERCONDUCTING MATERIALS

T.H. GEBALLE, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DF035580; AF-AFOSR-2435-73)

High-temperature superconducting materials are needed for application in airborne multimegawatt power generation and conditioning systems. Research specifically directed toward the synthesis and characterization of high-transition-temperature metallic compounds can provide a greater margin of design efficiency and operational reliability than presently available superconductors. The performance of high field magnets and solenoids, electric motor windings, superconducting rotors in power generators, transformers and induction energy storage systems could be significantly improved if the upper critical field, the current-carrying capacity and the critical transition temperature of the superconducting material could be enhanced. This is an experimental program to synthesize new and unusual superconductors. The behavior of Tc as a function of composition and structure is being investigated. Novel thermal methods as well as electrical and magnetic measurements are used to study the superconducting transitions. A variety of techniques such as physical and chemical codeposition, vapor transport on both hot and cold temperature substrates and high pressures are used in synthesis. Of particular interest are intermetallic compounds between transition elements which have unfilled d-shells and the metalloid of groups from boron to sulfur of the periodic table. Films of A15 compounds of niobium and vanadium with combinations of group III and group IV elements are to be synthesized by deposition of carefully controlled evaporated beams onto substrates whose temperature can be varied. Ternary compounds will be included. Sensitive heat capacity techniques are to be used to investigate the superconducting properties of these films. The anisotropic electrical properties of the superconducting dichalcogenides and their intercalation complexes will be studied through analysis of their magnetic heat capacity, as well as by nuclear quadrupole resonance techniques.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0003, INFLUENCE OF HYDROGEN ON MECHANICAL BEHAVIOR OF ALPHA TITANIUM ALLOYS

N.E. PATON, Rockwell International Corp., *Thousand Oaks, California* 91360 (DF042380; F44620-76-C-0025)

Af function - titanium and its alloys have been of considerable interest to the Air Force because of very favorable strength-to-weight characteristics at temperatures from cryogenic up to 800 degrees F, and resistance to attack by many chemicals. Potential applications for skins, structural and engine components of high-performance aircraft, cryogenic fuel shortage tanks for missiles, and tubing for transporting corrosive fuels all

emphasize the available materials roles for titanium alloys. Opportunity e despite improvements in processing techniques, all commercial titanium products contain residual hydrogen which can, under certain conditions, influence their mechanical behavior. The effects of such residual hydrogen on the properties of titanium are of primary importance from a practical point of view, but these effects are incompletely understood in the more complex commercial alloys. Consequently, hydrogen is often overlooked as the cause of variability in the mechanical behavior of these alloys. The mechanisms by which internal hydrogen influences loss of ductility, a decrease in fracture toughness, and increase in creep rate and an increase in both sustained load and fatigue crack growth rates is not well understood. Objective - this research will determine the influence of hydrogen on these and other mechanical properties. Approach - a systematic study of the effect of stress on hydrogen solubility, and tensile, creep, fatigue and sustained load cracking properties of Ti-Al and Ti-Sn specimens, with and without notches, and over a range of temperatures will be carried out.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0004, ELECTROCHEMISTRY OF SOLUTES IN CHLOROALUMINATE SYSTEMS

R.A. OSTERYOUNG, Colorado State University, Graduate School, *Fort Collins, Colorado* 80521 (DF043300; AF-AFOSR-2978-76)

AF function - communications and flight operations depend on auxiliary battery sources for power. Deficiency - lighter weight, higher temperature, longer life, and higher energy batteries are needed to meet the requirements. Objective - this research involves an understanding of the solution processes by which solute materials interact with certain acid solvents. These solvents are promising as battery fluids, and as systems for metallurgical separations. How work contributes - research results have the potential of improvement in high-energy-density batteries, corrosion prevention, new approaches for thermal batteries, and innovations for auxiliary power sources.

This research concerns a study of the behavior of oxides in chloroaluminate melts. These high-valent metal oxides are candidates for cathode materials. A study is to be made on sulfur and sulfides in the chloroaluminate systems as they are soluble in the acid melts. In addition, the solvent, solute properties of low-temperature Lewis acid systems, such as ethylpyridinium bromide-aluminum chloride melt, will be investigated, due to its potential as a solvent for both sulfides and oxides. High-temperature ring-disc electrodes will be used in these studies.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NC Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0005, MECHANISTIC STUDIES OF THE EFFECT OF LEAD SALTS ON DOUBLE-BASE PROPELLANT COMBUSTION - THE USE OF MODEL SYSTEMS 13249-C

J.B. LEVY, George Washington University, School of Arts & Sciences, *Washington, District of Columbia* 20006 (DA0V5574; DAAG29 76 G0087)

To investigate the effect of lead salts on the kinetics and the mechanism of combustion of double-base propellants. The results will have direct application to Army programs involving the combustion and ignition of propellants. In particular, this project is directly relevant to the Interior Ballistics Laboratory's ongoing project in the mechanism and chemical kinetics of nitrocellulose decomposition.

Burning rates of the solid propellant will be measured as functions of pressure, composition, the presence of catalyst, particle size and other relevant parameters as they become apparent. Temperature profiles will also be measured. In addition models for the combustion process will be developed using the data from the solid-propellant studies in conjunction with combustion data on simple systems such as the nitrate esters.

ADDENDA: Supporting Agency Address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

3.0006, EVALUATION OF CHEMICAL RESEARCH RELEVANT TO CURRENT AND PROJECTED U S AIR FORCE INTERESTS

J.E. EARLEY, Georgetown University, School of Arts & Sciences, *Washington, District of Columbia* 20007 (DF039870; F44620-75-C-0001)

AF function - flight operations, communications, and logistics rely on superiority in the materials, propulsion, and avionics technologies. Deficiency - advances in the technologies need long lead time discoveries in scientific chemical research. Objective - this effort provides in-depth expert scientific evaluation of proposed research programs in the field of chemistry. How work contributes - the results of the evaluations contribute to the selection of chemical proposals of the highest scientific merit. This, coupled with the scientific and relevance assessments made by AFOSR scientists, makes up the highly competitive and balanced selection procedure.

This effort provides the means for in-depth scientific evaluation of chemical research proposals by leading scientists in the nation. The panel is made up of fourteen experts from the academic, industrial, and governmental chemical science communities. Activities typically include two meetings of the panel each year, the in-depth review of selected research proposals, and other expert consultation, as requested. The determination of Air Force relevance, the in-house scientific review, along with the in-depth scientific review by the evaluation panel, insures the selection of high-quality research for inclusion in the AFOSR, Directorate of Chemical Sciences' program.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NC, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0007, NAVY VEHICLE DESIGN AND CONSTRUCTION - DEFORMATION AND FATIGUE IN BETA TITANIUM ALLOYS

E.A. STARKE, Georgia Inst. of Technology, School of Chemical Engineering, *Atlanta, Georgia* 30332 (DN123525; N00014-75-C-0349)

Beta titanium alloys are seeing increased use in aircraft because of their many desirable properties--light weight, good strength and ductility, and corrosion resistance. This project will develop needed information on the mechanical properties of new beta titanium alloys that show promise of excellent formability and toughness.

A series of beta titanium alloys have been selected which provide a wide variation of microstructures, including deformation-induced martensite, omega and alpha precipitates, and the homogeneous beta phase. The fatigue behavior of these alloys will be examined and compared. Deformation character will be altered by controlling the volume fraction of omega and associated effects on crack propagation resistance noted.

ADDENDA: Supporting Agency Address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0008, FRACTURE STUDIES OF HIGH-TEMPERATURE CERAMICS

D.L. JOHNSON, Northwestern University, School of Technology, *Evanston, Illinois* 60201 (DF042280; AF-AFOSR-2920-76)

The performance and cost of jet engines are factors of high interest in any flight vehicle design. Ceramic materials offer increased performance and efficiency through higher operating temperatures and greater thermodynamic efficiency. Simple fabrication procedures for ceramic materials would yield high cost savings over the intricate cooling structures required for refractory metals in current use. The key factor in using ceramic materials is their high-temperature strength but brittle behavior. This study will determine the resistance of ceramic turbine materials to impact damage at temperatures up to 1400 degrees C and in various gaseous atmospheres. An instrumented impact tester will be developed and calibrated in the initial experiments to obtain the surface energy, the critical stress intensity factor and the impact strength.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0009, NAVY VEHICLE DESIGN AND CONSTRUCTION - MECHANISMS OF HYDROGEN EMBRITTLEMENT IN METALS AND ALLOYS USED IN NAVAL STRUCTURES

H.K. BIRNBAUM, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DN123376; N00014-75-C-1012)

This research undertakes to clarify the mechanisms by which hydrogen can embrittle metals and alloys, such as those used for naval aircraft and ship structures.

Crack initiation and propagation mechanisms in niobium-hydrogen, iron-hydrogen and titanium-hydrogen alloys are being investigated. Temperatures and hydrogen content are being varied so that cracking may be studied in alloys both with and without the presence of precipitated hydrides. Acoustic emission techniques are being used to monitor crack growth and, in certain cases, radioactive tracers are being used to determine diffusion characteristics. Third-element doping is being studied to determine the diffusion characteristics and the effect on hydrogen diffusion rate and crack growth rates.

ADDENDA: Supporting Agency Address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0010, ELECTROMAGNETIC SHIELDING EFFECTIVENESS OF COMPRESSED GRAPHITE AND WIRE-GRIDDED COMPOSITE MATERIALS

K.F. CASEY, Kansas State University, School of Engineering, *Manhattan, Kansas* 66502 (DF043380; AF-AFOSR-2980-76)

AF function - Air Force systems of the future will increasingly use materials other than the metals in use today. The advantages in strength and in weight savings can be considerable. However, such materials must also provide adequate shielding of the system to the penetration of electromagnetic energy. If they cannot, the materials will be unacceptable for systems that may be subjected to an electromagnetic pulse (EMP) threat from a nuclear weapons detonation. Deficiency - the electromagnetic shielding effectiveness of the newer materials must be investigated. A great deal can be learned from theoretical studies which can have wide applicability to systems. Objective - the transmission of electromagnetic radiation in the low-to-medium frequency range through planar and cylindrical layers of compressed graphite and wire-gridded composite material (WGCM) is to be investigated. The effectiveness of these materials as shields against the penetration of electromagnetic energy such as EMP will be determined. Contribution - it is the aim of this research to consider some basic electromagnetic problems related to compressed graphite and WGCM by studying the penetration of monochromatic plane electromagnetic waves through a thin layer of material which is either in the form of a planar slab or of a cylindrical shell.

Compressed graphite may be modeled as a homogeneous, isotropic glossy material of high conductivity. The analysis of electromagnetic problems involving this material in simple geometries is straightforward. A wire-gridded composite material (WGCM) may be modeled as a dielectric with permittivity roughly three times that of free space and permeability equal to that of free space, with a rectangular grid of wires embedded in the surface. The junction points where the wires cross may or may not be in contact; in general there will be a finite ohmic resistance at each junction. It is known that rectangular wire grids in free space provide good shielding against the transmission of EM fields up to frequencies where the perimeter of a single cell of the grid becomes comparable in size to a free-space wavelength. The effect of the dielectric layer in combination with the wire grid has not been considered previously. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0011, EFFECT OF HEATING RATE ON NITRAMINE DECOMPOSITION

J.J. ROCCHIO, U.S. Army, Ballistic Research Labs., *Aberdeen Proving Ground, Maryland* 21005 (DA0H4510)

To provide a self-consistent set of experiments to evaluate the effect of heating rate on the indentity and relative amount of propellant thermal decomposition products. This information will add to the data base required for modeling of the propellant ignition process.

The initial phase of this study will be devoted to nitrocellulose using samples which are well characterized as to purity and percent nitrogen. The techniques to be used are thermogravimetry/mass spectroscopy and a platinum resistance probe coupled with a gas chromatograph/mass spectrometer.

ADDENDA: Supporting Agency Address is: DARCOM Ballistic Research Labs, Aberdeen P G MD 21005

SUPPORTED BY U.S. Dept. of Defense - Army

3.0012, GROWTH OF CARBON PARTICLES IN ROCKET EXHAUST

D. MANN, Aerodyne Research Incorporated, *Bedford, Massachusetts* (DF037390; F44620-74-C-0005)

Rocket and turbojet plumes represent targets to the enemy. In order to lessen these targets, the plume properties must be better understood. This work is investigating the growth of carbon particles in plumes. The program is now studying pure carbon vapor/carrier gas mixture at temperatures from room temperature to about 2400 degrees K. The growth of carbon particles from these mixtures is determined as a function of temperature and pressure. In subsequent work the particle growth rate will be studied when additives are mixed with carbon vapor. The additives will include hydrocarbons, hydrocarbon-oxygen mixtures and metal compounds. The measurement technique is optical scattering from the flow in which the characteristic resonant scattering from carbon atoms, C2 and C3, is followed to determine the gas temperature as well as the concentrations of these species. Also included as a diagnostic is mass spectrometry, for particles from C3 to C250. The size and concentration of carbon particles will be determined as well as the rate of formation.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0013, SEMICONDUCTOR DEVICE MATERIALS AND STRUCTURES

J.K. KENNEDY, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF901040)

AF function - communications. Deficiency - materials limit the fabrication of suitable devices. Objective - 1) to develop a capability for the preparation of improved bulk gallium arsenide and indium phosphide crystals for use as substrates in microwave devices; 2) to determine the epitaxial growth parameters necessary for the preparation of epitaxial structures for high-frequency and high-power FET's, infrared detectors, radiation damage and ion implantation studies. How research contributes - gallium arsenide and indium phosphide microwave devices have enormous potential for the Air Force, especially in terms of radar and communication systems. High cost and a lack of reliability and reproducibility are prime deterrents to their incorporation in systems. One of the main reasons for high cost, unreliability, and non- reproducibility is poor substrate quality. Work to be conducted should lead to improved substrate materials for device fabrication.

Our approach assumes that the underlying reason for the poor electrical properties of commercial gallium arsenide is impurity incorporation from the growth apparatus. Using a modified liquid encapsulation Czochralski technique, we will study the effect of varying crucible materials on the electrical properties of the gallium arsenide grown. The growth of indium phosphide will be studied concurrently. Using a hydride system we will grow high-resistivity layers of gallium arsenide. We will evaluate these layers as buffer layers for FET fabrication and also determine the growth parameters necessary to provide the doping and thickness control necessary for growth of the active layers of an FET structure.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440$

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0014, ORGANOSILICON COMPOUNDS AND ORGANOSILICON POLYMER INTERMEDIATES

D. SEYFERTH, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DF041490; AF-AFOSR-2917-76)

Air Force operations require new and improved materials to serve a wide variety of critical functions in advanced aircraft and missiles. Fluids and lubricants are needed as hydraulic fluids, coolants, engine oils, and gyro fluids, seals and sealants serve indispensable needs for fuel, liquid and air retention, and expulsion bladders in liquid rocket systems. Organosilicon compounds are among the promising candidates in this area. This research involves the investigation of (1) the synthesis and chemical reactions of silacyclopropanes, (2) the possible existence of other stable metallocyclopropanes, (3) the synthesis of bridged silanes, and (4) the generation of new difunctional organolithium or magnesium reagents suitable for the introduction of organic groups in bridged disilanes.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NC, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0015, BIAXIAL LOADING OF REFRACTORY MATERIALS AND HIGH-STRENGTH ALLOYS

P.T. LUM, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4691)

The objective of this investigation is to examine factors that influence the response of high-strength alloys and structural ceramic materials to certain features of biaxial loading. The major thrust for this program is survivability (aircraft and combat vehicles).

The response of high-strength materials to biaxial loading cannot be predicted by uniaxial behavior such as tension or compression. This is true of loading under pure shear (torsional) conditions. Therefore, it is proposed to examine the factors that influence the pure shear behavior of ultra-high-strength steels. It is planned to expand this effort to low-cycle fatigue under strain-controlled torsional loading and develop techniques for evaluation under a dynamic torsion condition. In addition, techniques will be developed and tests conducted which will allow evaluation of structural ceramic materials under biaxial loading.

ADDENDA: Supporting Agency Address is: DARCOM Materials and Mechanics Research Center, Watertown MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0016, LASER DAMAGE TOLERANCE OF COMPOSITE PANELS

J. PLUMER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4747)

Current aircraft fuselage construction features a skin supported by stringers and frames. The foreseeable threats of mid-intensity warfare, in this study, high-energy lasers, appear capable of destroying substantial portions of such structures with a single hit. The objective of this research will be to assess damage tolerance of composite panel materials suitable for monocoque fuselage construction. Such construction avoids severe structural degradation resulting from projectile impact and explosive rupture of a frame and several adjoining stringers by eliminating these elements and carrying all aerodynamic loads in the composite 'skin'. Monocoque construction not only avoids the thin skins susceptible to rapid burn-through by high-intensity radiation, but also permits utilization of laser-inhibiting materials as a structural component of the fuselage. Through assessment of damage tolerance, this research will develop composite panel materials optimized for aircraft survivability against the indicated threats.

Panel sections will be fabricated in various designs embodying combinations of fiber-reinforced skin and core materials in selected configurations. These panels will be subjected to damage by high- intensity radiation. The nature of damage will be determined and degradation of structural properties measured. Through analysis of test data, design criteria for composite panel materials tolerant of such damage will be established.

ADDENDA: Supporting Agency Address is: Darcom Materials and Mechanics Research Center, Watertown MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0017, DEVELOPMENT OF PIEZOELECTRIC POLYMERS FOR AIRCRAFT MONITORING DEVICES

R.J. SHUFORD, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4722)

To develop high-temperature piezoelectric polymers for application as on-condition monitoring devices to monitor stress and vibratory levels in aircraft systems operating in temperature ranges of minus 40 degrees C to plus 200 degrees C. To prepare and characterize highly active piezoelectric polymer films through optimization of processing variables, and to achieve a better understanding of piezoelectric behavior in polymers.

Piezoelectric polymer films will be prepared from commercially available homopolymer and copolymer films by various stretching and high-voltage poling processes and then will be characterized by determining the piezoelectric response, sonic modulus, dielectric properties, and other pertinent parameters. Preparation and characterization will also be done for high-temperature piezoelectric polymer films obtained from in-house or contractual synthesis of high- temperature polymers having a glass transition greater than 200 degrees C. Simple monitoring devices made from these films will be attached to model structures and subjected to mechanical loading to determine the potential applicability of these devices to a variety of simulated service conditions.

ADDENDA: Supporting Agency Address is: DARCOM Materials and Mechanics Research Center, Watertown MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0018, DEVELOPMENT OF POLYMERIC MATERIALS FOR TRANSPARENT LIGHTWEIGHT ARMOR

A.F. WILDE, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4693)

To develop improved polymeric materials for transparent lightweight armor in aircraft and ground vehicles. Major thrust is survivability, aircraft and combat vehicles.

Further variations in composition, stoichiometry, and structure will be formulated with polyurethane block copolymer systems to improve applicability. Other types of phase-segregated transparent block copolymers will be synthesized for evaluation as ballistic protective materials. Selected promising new transparent polymers will be investigated as backing materials in glass-faced laminate systems. Various transparent adhesives will be evaluated as interlayers in laminates which contain polyurethane or other new materials as backup plates. Room-temperature ballistic testing will be accompanied by high- speed photography. Ballistic and optical properties of selected transparent polymers will be investigated over a range of temperatures. Deterioration studies will be performed with transparent armor materials.

ADDENDA: Supporting Agency Address is: DARCOM Materials and Mechanics Research Center, Watertown MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0019, EUTECTOID DECOMPOSITION IN TITANIUM ALLOYS

H.I. AARONSON, Michigan Technological Univ., School of Engineering, *Houghton, Michigan* 49931 (DF038240; AF-AFOSR-2595-74)

AF function - a rational basis for materials development is required to assure the availability and effective utilization of structural materials in future Air Force systems. Opportunity - the fundamental methodology to provide comprehensive and systematic improvement of existing metallic materials and creation of new materials is dependent upon an understanding of the physical metallurgy of alloys. Objective - this investigation will deduce the principles underlying the eutectoid decomposition processes in titanium alloys. How work contributes - understanding of these phase transformations is necessary in order to furnish a more substantial base for the development of useful titanium alloys in which these processes play an important role in determining their microstructure and mechanical properties at room and moderately elevated temperatures.

Specifically, this research will determine why the massive transformation of beta to fully supersaturated alpha occurs in some Ti-X eutectoid systems but not in others, and the ability of the bainite reaction to compete with pearlite formation in hypo-eutectoid and eutectoid alloys.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0020, EVALUATION OF METHODS TO PRODUCE AVIATION TURBINE FUELS FROM SYNTHETIC CRUDE OILS

H. SHAW, Exxon Res. & Engineering Co., *Linden, New Jersey* 07036 (DF456950; F33615-74-C-2036)

This program will be conducted in three phases. The objective of phase 1 is to determine which raw materials and processes will provide refinery feedstocks most amenable to production of finished aviation turbine fuel. Raw materials will include coal and oil shale and their individual sources. The objective of phase 2 is to provide an experimental base in support of production of aviation turbine fuel from synthetic crude oil. Phase 3 will provide an overall assessment of material, equipment and processing requirements for producing the high yields of aviation turbine fuels from coal and oil shale.

Phase 1 will consist of an engineering analysis and include a literature survey. Raw materials, processes, synthetic crude oils and refinery feedstocks will be selected for further study in the later phases. Phase 2 will be limited to laboratory bench-scale experimentation as pilot-plant work is not within the scope of this program. Under phase 3 requirements unique to production of aviation turbine fuels and to production of other liquid products (gasoline, heating fuels, etc.) will be identified.

ADDENDA: Supporting Agency Address is: AF Aero-propulsion Laboratory SFF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0021, MULTIPLE IGNITION, COMBUSTION AND QUENCHING OF HYDROCARBON FUEL SPRAYS

W.A. SIRIGNANO, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DF044230; AF-AFOSR-3041-76)

AF function - weapon delivery and defense, aircraft component vulnerability and survivability. Deficiency - insufficient understanding of the basic physical, chemical and fluid dynamic processes of multiple ignition propagation, attenuation and quenching of flames and detonations in reactive hydrocarbon-air fuel sprays and mists and lack of realistic guidelines for predicting properties and effectiveness of potential flame/detonation quenching techniques. Objective - to clarify the relative influence and to formulate realistic analytical representation of the mechanisms responsible for multiple ignition by hot metal particles, combustion, detonation and quenching of hydrocarbon fuel sprays and mists occurring in air-breathing propulsion system dry bay and fuel tanks. How work contributes - will provide additional understanding of, and analytical models realistically describing the initiation, combustion propagation, attenuation and quenching mechanisms of flames and detonations in reactive media not now available, and will contribute to establishing realistic guidelines for minimizing the ignition probability, for developing of effective flame and detonation arrestors and, in general, reducing aircraft vulnerability and increasing survivability.

Mechanisms for ignition, combustion, and quenching of hydrocarbon fuel sprays occurring in the dry bay and fuel tanks associated with air- breathing propulsion systems will be examined. The emphasis will be on the basic physical, chemical, and fluid mechanical phenomena. The relative importance of various mechanisms will be considered; initially, hot metal particle clouds would be given special consideration as multiple ignition sources, with emphasis on aluminum and magnesium systems. Both deflagration and detonation combustion phenomena will be considered. Experimental facilities and instrumentation will be established to simulate the practical phenomena of interest. Any deficiencies in existing models will be demonstrated. Improved models will be formulated on the basis of existing experimental data and field observations. Parametric studies will be made to determine the most important parameters and their influences on the ignition, combustion, and quenching phenomena. The experiments will be revised on the basis of theoretical results. The predictive capability of the theory will be established. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0022, WATER DIMER INVESTIGATION

J.S. MUENTER, Univ. of Rochester, School of Arts & Sciences, *Rochester, New York* 14627 (DF244400; F19628-75-C-0063)

AF function - defense meteorological satellite. Deficiency - presently the effect of the water dimer for atmospheric probing in the infrared and microwave is unknown. Objective - using supersonic nozzle techniques for the formation of the water dimer, microwave, beam and stark effect measurement will be utilized to obtain the structure of the molecule. The thermodynamic properties of this molecule will be studied and as much information as possible on the effect of the dimer on atmospheric radiation will be inferred. How research contributes - the results of this research will determine the basic molecular structure of the molecule which is not presently known. It will provide direct results on many of the microwave transitions of the molecule and on the dipole moment of the molecule which quantity is necessary to calculate the transition intensities in the far infrared. The approximate frequency of the vibrational frequencies in the infrared will be inferred as well as the rotational spacing in these bands and their approximate intensity.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory OP L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0023, NAVY VEHICLE DESIGN AND CONSTRUCTION - DEFORMATION AND FRACTURE OF COMPOSITE MATERIALS

N.S. STOLOFF, Rensselaer Polytechnic Inst., School of Engineering, *Troy, New York* 12181 (DN123038; N00014-75-C-0503)

Directionally solidified composite materials can have exceptionally high creep and yield strengths. Such materials can be used in turbine blading to permit higher operating temperatures and efficiencies in jet engines. The investigators will examine effects of microstructure on mechanical properties and fatigue resistance in several directionally solidified alloys.

The fatigue properties of directionally solidified eutectics will be examined to determine the effects of microstructural refinement and heat treatment. Fatigue crack nucleation and fatigue crack growth will be followed using scanning electron microscopy. The strain-lifetime relationship of nickel base-TaC eutectics in low-cycle fatigue will be found for the temperature range from room temperature to 1000 degrees C.

ADDENDA: Supporting Agency Address is: Office of Naval Research 471, Arlington, VA. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0024, GRAIN BOUNDARY ENERGETICS IN NON-OXIDE CERAMICS

A.H. HEUER, Case Western Reserve Univ., School of Engineering, *Cleveland, Ohio* 44106 (DF040300; AF-AFOSR-2789-75)

AF function - small economical ceramic turbine engines are being developed for the propulsion of Air Force vehicles, RPV's for example. Opportunity - silicon carbide and silicon nitride-type ceramics, formed by sintering or hot pressing powders at high temperatures, provide strong vanes and blades for such turbines. Densification aids and subsequent high temperature creep of these materials are based upon empirical trial and error. Objective - this research program will investigate the mechanism of sintering in silicon carbide, silicon nitride and other ceramics. The deformation and creep mechanisms will also be studied. How work contributes - provides basis for improved aircraft engines.

The grain boundary energetics will be studied by measuring the dihedral angles at grain boundary - pore intersections using transmission electron microscopy. Adjusting the grain boundary

energy with additives will change the fabrication parameters and alter the high-temperature creep behavior of these materials.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0025, TURBINE ENGINE INTEGRATION ANALYSIS PROCEDURES

E.G. BLEVINS, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF452670)

To generate the propulsion system (inlet, engine, exhaust) performance trends and establish the engineering techniques necessary for improving delivered thrust-fuel flow characteristics during engine part-power operation.

Generate time-phased analysis and test techniques that forecast elemental propulsion system performance to defined levels of accuracy. Identify critical tests that must occur to define exhaust system - engine performance intereffects. Identify engine and exhaust system internal changes that are necessary to maximize delivered thrust at low throttle ratios.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory TBA, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0026, HYDROCARBON FUEL RESEARCH IN AN ADVANCED AIRCRAFT FUEL SYSTEM SIMULATOR

R.P. BRADLEY, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF451380)

Evaluate the overall performance and thermal stability limits of present operational and new candidate hydrocarbon jet fuels under simulated flight conditions to (1) determine the thermal limit and tolerance that these fuels provide when tested under various realistic flight profiles defined for aircraft systems under development and future aircraft, (2) examine the effect of various refining techniques, dissolved oxygen removal, and additives on fuel thermal stability, (3) provide a spectrum of fuel performance data that can be utilized by manufacturers in the design of engine and airframe systems, and (4) provide quantitative objectives to aid in the development of small-scale test methods.

The existing advanced aircraft fuel system simulator will be used as the primary test device. The thermal stability of fuels in various system components, e.g., tanks, oil coolers, manifold tubes, will be determined. The simulator will be modified to provide simulation of the B-1 and F-15 fuel systems using JP-4 fuel. JP-4 will also be evaluated to establish temperature limits of the fuel. Parametric investigations of various modified versions of JP-type fuels (hydro-treated and desulphurized) and deoxygenation tests will be conducted. In addition, advanced fuel candidates will be evaluated.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory SFF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0027, DEVELOPMENT AND APPLICATION OF AIRCRAFT FUELS

R.D. BUTLER, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF454850)

Develop fuel and fuel-additive blends satisfying the unique requirements of specific aircraft and missile systems. Provide technology required to preserve desired fuel properties throughout fuel storage and delivery systems.

A. Fuel blending -- Shelldyne H and other fuels will be blended to achieve high heating values yet reduce viscosity to acceptable values. Shelldyne isomers will be isolated and reblended to achieve the same goal as with blending. B. Analysis -- specialized gas chromatographic, infrared, etc., methods will be developed to identify fuel composition and in particular to identify trace materials in fuel known to have been degraded relative to some property such as thermal stability. C. Containment -- advanced fuels will be exposed to proposed contaminant materials and subjected to specification tests. D. Cleanliness -- new additives will be evaluated in small- and large-scale filter/separator equipment to determine if solids and water removal capability is affected. Equipment and instrumentation for monitoring fuel cleanliness will be evaluated as it is made available. Oxygen will be regarded as a contaminant if deoxygenation becomes a requirement to provide adequate thermal stability in new aircraft systems. Provision is included here to support any development of deoxygenation systems as needed.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory SFF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0028, LONG WET STAND SILVER OXIDE-ZINC MISSILE BATTERY

M.P. DOUGHERTY, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF452220)

To determine (in-house. AFAPL) parametrically the charged-wet stand characteristics of speciallY built and procured silver oxide-zinc battery cells which use a new separator material (radiation-grafted polyethylene). The practicability of using such cells, in batteries, will be determined with the purpose of eventually providing a more compact and lighter battery than the currently used reserve-type batteries.

Phase I - store charged cells in the wet state at 70, 115, and 150 degrees F for periods of 1, 2, 3, 6, 9, 12, 18, 24, 30, 36, 48, and 60 months. Measure capacity after storage. The cells are specially fabricated using RAI P-2291 separator material. Phase II - store charged cells in the wet state at 70, 90, and 110 degrees F for periods of 12, 18, 24, 36, 48 and 60 months and measure capacity after storage. These cells are specially fabricated using laminates of RAI P-2291 and cellophane.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory POE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0029, ADVANCED FIRE, EXPLOSION AND OVERHEAT DETECTION CONCEPTS FOR AIRCRAFT

D.G. FOX, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF451630)

To select a multiplexing technique, pulse code modulation (PCM), pulse amplitude modulation (PAM), etc., and determine the most optimum method for using all available hazards sensors to inform crew members of the type, location and size of hazard and what should be done about it. To directly digitize and address transducers so that interrogation by the multiplexer can be direct and efficient. A flight-qualified system capable of providing rapid collated instructions and information to crew members is the goal of this program.

Select an optimum multiplex technique for aircraft use. Purchase an off-the-shelf unit for testing having the qualifications defined above (number of words, clock frequency, number of bits in a word, etc.), analyze available transducers for the direct application to the multiplexer and design new electronics as required. Analyze hazardous areas to determine information and sensor requirements. Build final unit.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory POD, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0030, FATIGUE CRACK PROPAGATION IN POLYMERIC MATERIALS 11180-MS

R.W. HERTZBERG, Lehigh University, School of Engin. & Phys. Sci., *Bethlehem, Pennsylvania* 18015 (DA0D9189; DAHC04-74-G-0010)

To study the propagation of fatigue cracks in polymeric materials and the relationship of such propagation to linear and nonlinear deformation behavior and to molecular and morphological features. Relevance - the proposed research should have an impact upon the design of polymers that are to be used (either monolithically or in composites) under cyclic loading, e.g., in Army helicopters, armored vehicles, and mortar tubes.

The following topics will be examined: (1) deformation properties, (2) internal molecular structure and properties, (3) response to external variables, and (4) nature of the mechanisms of deformation.

ADDENDA: Supporting Agency Address is: DARCOM Army Research Office, Research Triangle Park NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

3.0031, A/C ENGINE EMISSION SURVEY
A. SOUZA, Scott Environmental Tech. Inc., *Plumsteadville, Pennsylvania* 18949 (DF407330; F29601-75-C-0046)

The accurate measurement of pollution emission factors and calculation of emission indices for carbon monoxide, hydrocarbons, oxides of nitrogen, and particulates from all operating modes of all aircraft engine models of significant Air Force usage. This will alleviate the current severe lack of pollution emission indices for Air Force engines and facilitate much more accurate assessments of environmental impact and proposed pollution control strategies.

The AFWL Mobile Emissions Laboratory developed under project 19008W06, Acc. Number 177310, will be taken to Air Force engine rework facilities and emissions will be measured during normal engine acceptance testing. Large numbers of engines will be tested to determine true means and engine-to-engine variability within each engine model. Data will be analyzed and emissions indices developed for all engines and conditions tested. Work will be performed by contractor selected by multiple source procurement.

ADDENDA: Supporting Agency Address is: AF Civil Engineering Center EVA, Tyndall AFB, Fla.32401

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0032, OPTICAL PROPERTIES OF IR LASER WINDOW MATERIALS
S.S. MITRA, Univ. of Rhode Island, School of Engineering, *Wakefield, Rhode Island* 02881 (DF900740; F19628-75-C-0163)

AF function - development of window materials for high-power carbon dioxide and chemical lasers. Deficiency - the optical absorption and temperature variation of refractive index of presently available window materials is not within acceptable limits for focusing high-power carbon dioxide and chemical laser beams on targets. Research - spectroscopic investigations to find window materials of low absorption and small temperature variation of refractive index at carbon dioxide and chemical laser wavelengths. How research contributes - improved materials for high-power carbon dioxide and chemical laser window application. Optical properties of halide, oxide and other potential window materials in the 2-6 and 10.6 micron wavelength region. Spectroscopic measurements will be made to determine vibrations, multiphonon spectra and raman scattering of these materials at 2-6 and 10.6 microns. Differences between crystalline, polycrystalline and amorphous materials will be investigated. The results of these studies and their theoretical interpretation will determine the parameters affecting optical absorption and temperature variation of refractive index in the vicinity of 2-6 and 10.6 microns.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0033, APPLICATION OF COMPOSITE TAILORING FOR FLUTTER SUPPRESSION
R.O. STEARMAN, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Within the last decade a great deal of research has been performed to study the usefulness of composite materials as a substitute for metal in aircraft. Some of the less exotic of the composites have in recent years been found to be superior structurally, as well as more desirable economically. Composites such as fiberglass, carbon-fiber, and boron- fiber, usually in an epoxy matrix, are found to be superior in their strength-to-weight characteristics to more conventional isotropic materials. There is, however, a less obvious property of these materials not available in normal isotropic metallic structures that may be used to some advantage by the alert designer. The fibers of a composite may be arranged unidirectionally or in directional layers to give anisotropic or unusual coupling characteristics between loads and deflections of a structure. This additional design parameter creates a property known as composite tailoring in which, under specified loading conditions, mechanical or thermal, the composite structure will change shape in a predictable and beneficial manner. It is believed that composite tailoring may be used to combat aeroelastic problems often found in high-performance aerodynamic vehicles. Research is under study to investigate the suppression of the flutter phenomenon in aircraft employing composite tailoring principles.

SUPPORTED BY University of Texas

3.0034, DEVELOPMENT OF MEMORY FUNCTION NORMS FOR SOLID ROCKET PROPELLANTS AND OTHER MATERIALS
J.E. FITZGERALD, Univ. of Utah, School of Engineering, *Salt Lake City, Utah* 84112 (DF034160; AF-AFOSR-2322-72)

This work is in direct support of research objective 5.1.3, examining the fundamental mechanical properties of solid propellants. A major problem with solid propellants used in a variety of AF weapons is internal damage due to deformation of the propellant grain. To improve shelf life and reliability of solid motors, an accurate assessment of the structural capability of a solid grain requires accurate constitutive laws. The goal of this program will be to conduct theoretical research on characterizing materials with memory. Phenomena such as fading, permanent and increasing type memory effects will be investigated using various viscoelastic materials. While the theoretical work is, of necessity, general in application, special emphasis will be given to solid propellants. In addition, experimental work will be conducted on filled polymers both for the purpose of discovering new coupled thermomechanical effects and to determine specific constitutive coefficients for inclusion into the equations. Algorithms will be developed to permit computer calculations so as to provide an engineering workable method for converting experimental data into numerical representations. A continuing effort will be expended to develop the methodology for including aging effects in the constitutive equations.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0035, ORIGIN AND CONTROL OF RESIDUAL STRESSES IN ATOMICALLY DEPOSITED MATERIALS 13464-MSX
J.C. WITHERS, Deposits & Composites Inc., *Herndon, Virginia* 22070 (DA0E9060; DAAG29 76 C 0030)

The objective of the investigation is to determine the origin of residual stress in atomically deposited materials. This research is relevant to programs at AMRDL, AMMRC, MERDC, and TACOM on the development of the high-temperature, ceramic, gas turbine for use in air and land mobility, as well as stationary and mobile power generators and to programs at MICOM to develop silicon carbide rocket nozzles. It is also relevant to the development of silicon carbide fibers for use in high modulus composites (MICOM and WVLT) for missiles, jet engines, and potentially for gun tubes.

The program will include systematic investigation of the effects of pressure, temperature, reactant ratio, and gas flow rate on the structure and residual stress of atomically deposited materials, study of the kinetics and mechanisms of relief of residual stress in atomically deposited materials during annealing, and formulation of a theoretical basis for origin, control, and relief of residual stress in atomically deposited materials.

ADDENDA: Supporting Agency Address is: DARCOM Army Research Office, Box 12211, Research Triangle Park NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, AFAPL SENIOR INVESTIGATOR PROGRAM
R. WEBB, Auburn University, Graduate School, *Auburn, Alabama* 36830 (DF459300; F33615-76-C-2050)

The objective of this effort is to obtain expert assistance in solving complex and persistent problems in air-breathing propulsion, laser aerodynamics, power generation and distribution, related systems and materials.

This effort is a dual award with both Purdue Research Foundation and Georgia Technology Institute. These institutions will provide senior investigators (post-doctoral scientists and engineers) to solve specific problems in the laboratory's technical areas. The efforts to solve the specific problems may last from several days to a year or more.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory POD, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0002, LOW-SPEED SEPARATED-FLOW STUDIES FOR NAVAL AIRCRAFT
P. DODGE, Signal Companies Incorporated, *Phoenix, Arizona* 85034 (DN475377; N00014-74-C-0317)

The effectiveness of aircraft, whether conventional or V/STOL, at low speeds is reduced by flow separation. The separation is caused by adverse pressure gradients induced by deflected control surfaces or high incidence angles of the wings. This research is a numerical approach, within the framework of the Navier-Stokes equations, to the development of a methodology for the calculation of low-speed separated flows for improved aircraft performance.

Flow separation on wings or control surfaces at low speeds is an extremely complex phenomenon which can, at this time, be described, in general, only by detailed experiments or possibly by numerical calculations for an extremely limited set of special cases. It is beyond the scope of conventional boundary-layer theory, and hence predictive procedures must rely on phenomenological modeling or higher order approximations. In the proposed investigation, the full Navier-Stokes equations will be solved numerically by a technique which involves splitting the momentum equation into two parts, not unlike boundary- layer theory. One part contains the inviscid-like pressure terms and can be solved by elliptic methods. The second part, which is of course coupled to the first equation, contains the viscous terms directly, is parabolic in nature, and can be solved by marching techniques. Iteration will be carried out for the coupling.

ADDENDA: Supporting Agency Address is: Office of Naval Research, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0003, RADIATION HARDNESS MOS/SOS COMPARATOR
D.T. BUTCHER, Rockwell International Corp., *Anaheim, California* 92803 (DF245710; F19628-75-C-0185)

AF function - radiation hardness of Air Force space and missile systems. Deficiency or opportunity - current nuclear hardness requirements for semiconductor devices and integrated circuits are not being met. How research contributes - this program will develop the techniques required to apply radiation-hardened MOS technology to linear/analog circuit applications.

An investigation of the techniques required to reduce the offset in threshold voltage of matched pairs of MOS transistors and to improve the tracking of the threshold voltages after radiation exposure will be performed. Device designs and processes will be developed to reduce the rapid increase in output conductance of N-channel MOS/SOS transistors with increasing drain voltage ('kink' phenomena). As a demonstration vehicle for the degree of success obtained in device improvement, A radiation hardened MOS/SOS voltage comparator will be designed and fabricated utilizing the improved devices developed.

ADDENDA: Supporting Agency Address is: AF Cambridge Research Laboratories LQ, L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0004, SOS FILM STUDIES
UNKNOWN, Rockwell International Corp., *Anaheim, California* 92803 (DF245460; F19628-75-C-0108)

AF function - radiation hardness of Air Force space and missile systems. Deficiency or opportunity - current nuclear hardness requirements for semiconductor devices are not being met. Objective - to investigate the defects and impurities in silicon-on-sapphire material which reduce the radiation hardness. How research contributes - the research will contribute to the understanding of the types and concentrations of defects and impurities in silicon on sapphire and how they relate to the radiation hardness of SOS devices. The results of this research will contribute to the development of a radiation-hardened technology for use in Air Force space and missile systems.

This program will investigate the sapphire substrate and silicon film to determine defect and impurity concentrations and distributions and will characterize the effects of such imperfections on electrical and radiation hardness parameters of devices fabricated in this material. Techniques for defect studies such as X-ray diffraction, minority carrier lifetime measurements, ion backscattering, and other appropriate techniques will be investigated. Samples of silicon-on- sapphire material will be studied using these techniques to identify types of defects and impurities and their concentrations. Devices such as MOS capacitors will be fabricated on these samples and the radiation hardness will be correlated with the defect and impurity studies.

ADDENDA: Supporting Agency Address is: AF Cambridge Research Laboratories LQ, L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0005, JOSEPHSON JUNCTION DETECTORS FOR RADIO ASTRONOMY
R. CHIAO, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (AST72-05136 A05)

A new type of millimeter-wave amplifier, the SUPARAMP (Superconducting Unbiased Parametric Amplifier), which utilizes a parametric interaction in unbiased superconducting microbridges, has been successfully constructed and tested at 10 and 33 GHz. The properties of this amplifier include low noise/temperature, wide instantaneous bandwidth, wide retunability, and simplicity of construction. These characteristics provide a significant improvement in capability when the SUPARAMP is used for radioastronomical observations. In the coming year the SUPARAMP will be used for radio astronomical observations. Its saturation and noise properties will be investigated carefully with a view to possible use of the device at higher frequencies.

This is a continuation of work previously supported under NSF grant AST 72-05316.

SUPPORTED BY U.S. Natl. Science Foundation

4.0006, IONOSPHERIC TURBULENCE AND MAGNETOSPHERIC-IONOSPHERIC COUPLING FOR EVALUATION OF RADIO COMMUNICATIONS
C.F. KENNEL, Univ. of California, Inst. of Geophys. & Pla. Phys., *Los Angeles, California* 90024 (DN323099; N00014-76-C-0307)

The objective is to evaluate the effect of the ionosphere on radio communication systems used in Navy operations and to help in the design and operation of such systems. The propagation and attenuation of high- frequency, very low-frequency, and very high-frequency radio signals by the ionosphere, by both ground-based and satellite transmitters, are governed by the electron and ion densities in the ionosphere. The present work develops a model to estimate these electron and ion densities as a function of latitude, longitude, altitude, season, time and solar activity. The work also has applications to the estimation of the effects on ionosphere communications due to high-altitude nuclear explosions used, for example, in ballistic missile defense.

Work will consist of investigations of ionospheric plasma turbulence, magnetosphere-ionosphere interactions, and magnetospheric substorms. In particular, the following topics will be considered: the role of photoelectrons in producing F-region irregularities, the viscous coupling of solar wind momentum to the mag-

netosphere and the associated ionospheric convection electric field and neutral wind pattern, and the saturation of the auroral electrojet instability.

ADDENDA: Supporting Agency Address is: Office of Naval Research 421, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0007, LASER WINDOW SURFACE FINISHING AND COATING TECHNOLOGY

M. BRAUNSTEIN, Hughes Aircraft Company, *Malibu, California* 90265 (DF900040; F19628-75-C-0135)

AF function - high-power laser weapons systems. Deficiency - inability of presently available optical components to efficiently transmit IR laser radiation. Research - to develop surface finishing and coating technology to provide coated systems that will have maximum transmittance at various IR wavelengths and high-power laser damage thresholds. How research contributes - coatings are required on laser windows to environmentally protect the window, and to allow maximum transmittance at selected IR wavelengths with a maximum of reflection (Ar coating). This contract will study and develop both the best surface preparation and the optimum coating system and the methodology of the coating preparation in order to optimize Ar properties and damage thresholds at a variety of ir wavelengths including 10.6 and 3-5 microns.

Provide the science and technology to establish surface preparative techniques and develop multi-layer thin-film Ar coatings for a variety of IR materials. Coating studies will be explorative in the sense that sputtering, ultra-high-vacuum (10 to the minus nine or better) and CVD methods will be compared and used when appropriate for a variety of IR transmissive materials. Integral part of such program is characterization by methods including optical scattering, ellipsometry, calorimetry and microscopy.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0008, ELECTRONICALLY TUNABLE UHF HIGH-POWER FI

A. KARP, Stanford Research Institute, *Menlo Park, California* 94025 (DF736780; F30602-76-C-0248)

The objective of this effort is to develop the filter technology necessary to increase the power-handling capability of electronically tunable filters on 1000 watts of cw power. This effort will be directed toward the military UHF communications band of 225-400 MHz; however, the technology will be applicable to other frequencies as well. A high-power (1000 watt) filter is required to reduce spurious emissions, broadband noise, and transmitter-to-transmitter intermodulation distortion on the class of emitters used on the Advanced Airborne Command Post (AABNCP) and Airborne Warning and Control System (AWACS) aircraft and ground stations.

Past efforts in electronically tunable filters have concentrated upon the use of pin diodes to control the capacitance of tuning irises used to change the filters' operating frequency. The power-handling capability of a filter using pin diode-controlled capacitive irises is limited to approximately 100 watts because of the diode's reverse-bias breakdown voltage. The approach to this effort is based on proprietary work performed by Stanford Research Institute parallel with Contract F30602-74-C-0142, Electronically Tunable UHF Filter. This proprietary work showed that the power-handling capability of an electronically tunable filter could be increased by a factor of 64 by using pin diodes to control inductive slots in the walls of a TEM resonator instead of the capacitive irises presently used. A one-year sole-source contract should be awarded to Stanford Research Institute to develop this technology and to fabricate a one-tuning code resonator operating in the UHF communications and to probe feasibility of the approach.

ADDENDA: Supporting Agency Address is: Rome Air Development Center RBC, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0009, SURFACE RADIATION EFFECTS IN HGCDTE

F.A. JUNGA, Lockheed Aircraft Corporation, *Palo Alto, California* 94304 (DF245810; F19628-75-C-0127)

Af function - surveillance, detection and weapons delivery. Deficiency - operational capability of IR detector systems can be seriously affected upon exposure to nuclear radiation. Objective - determine the long-term effects of ionizing radiation on the surface properties of HgCdTe IR detectors. How research contributes - since both detector sensitivity and noise are affected by surface properties, this data is needed to assess the performance of HgCdTe IR detectors exposed to nuclear radiation. Data is also provided to develop techniques to harden these detectors to radiation.

MWIR (3 to 5 microns) and LWIR (8-14 micron) HgCdTe photoconductive detectors with special metal field plates will be irradiated with cobalt-60 gamma source at 77 degrees Kelvin. Before and during irradiation as well as after post-irradiation anneals, surface properties will be measured using capacitance-voltage and conductance- voltage techniques. At the same time detector performance parameters including responsivity and detectivity will be measured.

ADDENDA: Supporting Agency Address is: AF Cambridge Research Laboratories LQ, L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0010, STUDY OF INFRARED UPCONVERSION TUNABLE LASERS

S. HARRIS, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DF900300; F19628-75-C-0046)

Af function - airborne reconnaissance, communications, surveillance. Deficiency - upconversion techniques and tunable lasers for above are inefficient. Objective - perform research on a new efficient upconversion technique and a new type of tunable laser. How research contributes - improve conversion efficiency from infrared to visible and provide new tunable coherent sources for above AF functions. The objective of the contract is to study a new, very efficient infrared upconversion technique utilizing resonantly two-photon pumped metal vapors. In particular, to search for coincidences between two photon absorption lines in suitable metal vapors and laser lines. Further, to investigate the various pertinent parameters with a view towards optimizing the conversion efficiency. Finally, the possibility of constructing a tunable, optically pumped sodium-xenon excimer laser will be explored.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0011, STRUCTURAL LIFE PREDICTION AND ANALYSIS TECHNOLOGY

T. CRUISE, United Technologies Corp., *Hartford, Connecticut* 06108 (DF458060; F33615-75-C-2063)

The objective of this program is to develop specific and accurate life prediction/analysis computer techniques for aircraft gas turbine engine components. The programs developed will be verified through testing and include capabilities for consideration of all necessary facets of mechanical and thermal cyclic fatigue. All programs will run on the WPAFB computer system and will be versatile so as to be able to analyze all types of engine component designs and materials.

This effort consists of developing under contract with major engine manufacturers a series of programs, related and integrated with existing AFAPL stress analysis programs, to predict component fatigue life. Included in the analysis will be effects of loading order, loading history, dwell time, material hysteresis, as well as interactive effects of creep, and plasticity. Each analysis will be verified through actual component testing as well as specimen testing to ensure accurate analytical techniques.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory TBP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0012, COMPRESSOR CRITICAL RESPONSE TIME DETERMINATION
R. MAZZAWY, United Technologies Corp., *Hartford, Connecticut* 06108 (DF457700; F33615-75-C-2036)

The objective of this effort is to establish an analytical relationship between certain design characteristics of a compressor and its dynamic response to inlet flow distortions, and then from this relationship generate the analytical techniques to predict the dynamic response in the form of a critical response time, for a compressor.

To avoid gross empirical correlations the compressor critical response time must be developed from unsteady airfoil analysis. The study of isolated airfoils with incidence angles that vary periodically shows that the airfoil can attain higher unstalled incidence angles than its steady-state limit. This leads to the concept of a lag or time constant associated with the flow field around the airfoil. Since all inlet flow distortions are felt by the compressor as variations in incidence angle, the development of time constants related to geometry will allow the prediction of the compressor critical response time for a given geometry.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory TBA, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0013, LOW-COST SMALL TURBINE ENGINE COMPONENT DEVELOPMENT
J. LUNNY, Avco Corporation, *Stratford, Connecticut* 06497 (DF455470; F33615-72-C-1844)

The objective of this effort is to design, develop and demonstrate low-cost compressor technology which is considered a critical requirement for a practical, low-cost, limited-life turbine engine.

The results of the low-cost, limited-life turbine engine analysis program indicated that the turbine and compressor components warrant the most attention in a component development program since they typically comprise 30 to 50 percent of engine cost. The approach taken in this program is comprised of three phases. In phase 1, a preliminary design based on engine cost trade-offs will be made for a low-cost engine. In phase 2, a detail design of the compressor will be made based on further cost trade-offs. In phase 3, the compressor will be fabricated and tested to determine performance and to demonstrate mechanical integrity.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory TBP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0014, SILICON EXTRINSIC DETECTOR
C.T. SAH, State Water Survey, *Urbana, Illinois* 61801 (DF901720; F19628-72-C-0199)

AF function - surveillance, detection. Deficiency - infrared detectors are vulnerable to nuclear radiation. Research - silicon as an extrinsic infrared detector is least affected by nuclear radiation. Fundamental studies on pertinent device and material parameters will be undertaken to fully characterize this material as infrared detectors. How research contributes - accurate device and material parameters, such as optical absorption cross-section, thermal capture rate, lifetime and mobility as a function of temperature, doping density and compensation levels obtained will enable broad-scale development of this detector based on firm scientific knowledge rather than art. Complete understanding and characterization will also allow further hardening of the detector.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0015, ANALYSIS OF MICROSTRIP RADIATING ANTENNAS
G.A. DESCHAMPS, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DF901280; F19628-76-C-0140)

AF function - antenna systems for high-speed aircraft, missiles, and aircraft-to-satellite communication. Deficiency - microstrip antennas that use more complex types of radiating elements than a simple slot or a rectangular plate have not yet been fully understood or analyzed. This is a major obstacle to further development and synthesis of new antennas. Objective - analyze microstrip antenna and radiating elements and provide manageable design formulas to allow synthesis of microstrip antennas and feed systems. How research contributes -provides HF antenna engineers techniques and tools to design flush-mounted antennas.

The fields that exist between plates of the microstrip antenna and its coupling to free space will be investigated. Curvature effects of microstrip antennas conformal to irregular surfaces, the interaction between elements and impedance of the various shapes of flat plates and slots will be analyzed and manageable formulas and design criteria determined. Simple experiments will be performed to verify the results of the theory.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0016, STABILITY AUGMENTATION SCALING
W. SPRINGER, General Motors Corporation, *Indianapolis, Indiana* 46206 (DF457340; F33615-75-C-2044)

The objective of this effort is to establish the usefulness of local metal matrix composites to increase the vibration stability of fan/compressor blades.

This program consists of five tasks. Task 1 is a design and analysis effort to parametrically define the influence of locally stiffening turbine engine fan/comressor blades using metal matrix composite inlays. Task 2 establishes the manufacturing processes to produce a low-cost, reproducible blade. Task 3 includes the fabrication of fan/compressor blading with the composite panel inlays. Task 4 emphasizes the verification of frequency, mode shape and strength characteristics using task 3 hardware. Task 5 covers the instrumentation, assembly and piggyback engine testing of a full stage of composite inlaid blade.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory TBP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0017, OPTICAL CABLE SYSTEMS FOR NAVAL AIRCRAFT
R.S. KATZ, U.S. Navy, Avionics Facility, *Indianapolis, Indiana* 46218 (DN030051)

To develop techniques to replace avionics systems wiring with fiber optics cables.

The program consists of four phases: (1) a study of optical cable system technology; (2)(a) define system parameters, (b) develop and optimize standard transmitter and receiver circuitry; (3)(a) environmental testing of cables, (b) develop a prototype optical cable system, optimized for aircraft, (c) establish packaging techniques for transmitters and receiver, (d) develop hardware including connectors for aircraft deployment, (4) install prototype cable system for test and demonstration; (5) a handbook for assembly and installation of optical wiring including design information will be prepared.

ADDENDA: Supporting Agency Address is: Naval Air Development Center, 304 Warminster, PA

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0018, DESIGN OF COMBINED NOZZLE BASE BOATTAIL SYSTEMS AND THE ANALYSIS OF 3-D TRANSONIC INTERNAL FLOWS
J. HOFFMAN, Purdue University, School of Mechanical Engin., *Lafayette, Indiana* 47907 (DF452150; F33615-73-C-2010)

The objective of this program is to extend the existing analytical capability for nozzles to include the design of combined nozzle base boattail systems and to investigate the characteristics of three- dimensional transonic internal flows.

A production-type computer program for the design of combined nozzle base boattail systems will be developed. The design will be applicable to axisymmetric nozzle and boattails, supersonic free stream conditions, and supersonic nozzle flows. Analytical techniques and a computer program will be developed for 3-D transonic flows.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory RJT, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0019, TRANSONIC FLOW IN NOZZLES
J. POLK, U.S. Army, Ballistic Research Labs., *Aberdeen Proving Ground, Maryland* 21005 (DA0H4468)

To establish a numerical method for the computation of the transonic parts of flows in supersonic nozzles. Data furnished by such computations are necessary for quantitative analysis of rocket motor performance.

Literature will be searched for methods and/or codes for the computation of transonic nozzle flow. If reliable computation methods can be obtained for symmetric flows, an attempt will be made to model a three-dimensional transonic flow through a symmetic nozzle.

ADDENDA: Supporting Agency Address is: DARCOM Ballistic Research Labs, Aberdeen PG MD 21005

SUPPORTED BY U.S. Dept. of Defense - Army

4.0020, FLUIDIC SEQUENCER FOR SEAT EJECTION
J.M. GOTO, U.S. Army, Harry Diamond Laboratories, *Hyattsville, Maryland* 20783 (DA0F5580)

To assist in the evaluation/demonstration of the feasibility of utilizing fluidics to obtain longer installed life and improved accuracy and reliability in the sequencing of seat ejection systems.

To assist the Naval Ordnance Station personnel by evaluating contractor-designed fluidic circuits, attend contractor program reviews, and help study the feasibility of using a 'continuous sensing' mode for aircrew escape system event sequencing.

ADDENDA: Supporting Agency Address is: DARCOM Harry Diamond Laboratories, 2800 Powder Mill Road, Adelphi, MD 20783

SUPPORTED BY U.S. Dept. of Defense - Army

4.0021, DUAL-BAND ARRAY TECHNIQUE
R. LEWIS, Raytheon Company, *Bedford, Massachusetts* 01730 (DF900720; F19628-75-C-0197)

AF function - aircraft-to-satellite communication and other aircraft flush-mounted applications. Deficiency - improved antenna performance is required, particularly to achieve independent beams at widely spaced frequencies. Research - investigation of new antenna techniques for dual-band array elements. How research contributes - most present array techniques allow only one beam to be scanned at one given frequency. The several exceptions that do allow dual independent beams have relatively low aperature efficiency. New dual-band array techniques would allow lightweight arrays with efficient use of the aircraft mounting space.

The approach is to investigate the properties of a particular kind of dual-band phased array technique that used dielectric slab-loaded waveguide elements to provide separate control of two widely spaced frequencies.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0022, THE EFFECT OF NEGATIVE SURFACE CHARGE ON SATELLITE
H.A. COHEN, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF245760)

AF function - surveillance or communication satellites. Deficiency - electrical charging of satellites causes failure of on-board electronic components. Objective - development and space flight of a positive-ion gun to induce controlled electrical charging. How research contributes - by simulating and controlling satellite charging, the effects on a satellite being charged while in orbit can be determined, and the extent and nature of deleterious effects on electronic equipment can be studied.

A system will be built to enable the controlled ejection of positive ions from a satellite. The system will meet the following specifications: weight less than 10 pounds, beam current greater than 1 milliamp, ion energy greater than 1 KeV, operating lifetime greater than 100 hours. The operational period of the ion source will be determined by ground commands. Using this system, either positive-ion or neutralized beams will be ejected from the satellite. The system will be used on the SCATHA satellite which will be launched in December 1977.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory LB L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0023, RADIATION EFFECTS IN SI AND GAAS FOR DEVICE DEVELOPMENT AND HARDENING
H.M. DEANGELIS, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF901820)

AF function - surveillance and reconnaissance. Deficiency - performance characteristics of electronic devices are degraded by space radiation environments and those created by nuclear weapons detonations. Objective - determine the properties of radiation-induced defects in electronic device materials including the effects of high-energy electrons and neutrons on silicon and gallium arsenide materials suitable for use in infrared detectors and microwave power devices, respectively. How research contributes - radiation-induced displacement damage changes the properties of device materials. Data concerning the production and stability of the defects responsible for these changes provides a basis for predicting the effects of radiation on device performance and in evolving techniques to radiation-harden materials and devices.

Carrier removal, defect energy levels and defect concentrations are derived from Hall effect and conductivity measurements on bulk samples and from capacitance measurements on p-n junction and Schottky-barrier diodes. Recovery of property changes and defect stability are determined from isochronal and isothermal anneals.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0024, TECHNIQUES FOR IMPROVED GAAS MICROWAVE DEVICES
D.D. EIRUG, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF901550)

AF function - solid-state device design and fabrication is relevant to Air Force missions in communications, weapons delivery and detection. Deficiency or opportunity - it is necessary to improve the performance of electronic devices in frequency, reliability, power consumption and radiation hardening so that the systems in which they are deployed will exhibit superior performance, reliability, and hardness. Objective - explore new solid-state device designs and fabrication techniques in order to improve semiconductor device performance in military environments. How research contributes - this research on device design and fabrication processes will contribute to systems that need high- frequency processing devices and power sources, such as phased-array radars.

Ions that are known to give acceptor or donor levels in Si and GaAs will be investigated in detail for physical and electrical characteristics. Determinations of implanted ion range, profile and associated damage will be made. Electrical characterization will be done via measurements of conductivity, mobility, carrier lifetime and trapping levels. In the case of GaAs, which is readily disassociated at elevated temperatures, the encapsulant that is used during the anneal becomes very important and thus becomes an additional parameter in this investigation.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0025, HIGH-FREQUENCY SWEPT-SPECTRUM COMMUNICATIONS (HFSSC)
T.J. ELKINS, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF900870)

AF function - survivable communications. Deficiency - need for reliable essential long-range communications under natural or nuclear ionospheric disturbance. Research - study effects of naturally occurring ionospheric disturbance in high latitudes upon swept-spectrum high- frequency (HF) modulated signals. How research contributes - the research will verify the feasibility of a new kind of minimum essential long-range communications under realistic conditions. An aircraft receiver will be used, flying in the polar regions along paths specially chosen so as to investigate effects of various ionospheric propagation anomalies. Data will be provided to assist in possible system design.

In FY76 a series of flights is planned in which special equipment, constructed and installed in the KC-135 in FY75, will receive transmission from Utah. The transmissions will consist of a modulated, highly linear swept-frequency carrier, the receiver will be synchronized with the transmitter. An on-board computer will decode the transmissions and perform statistical analysis of the demodulated data.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0026, LONG-WAVE IONOSPHERIC PENETRATION

R.B. HARVEY, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF901540)

AF function - to improve Air Force long-range communications, navigation and timing systems by VLF/ELF radio wave propagation through the ionosphere. Deficiency or opportunity - lack of information on VLF/ELF ionospheric radio wave absorption, reflection, and transmission, as well as noise sources and their parameters hinders the Air Force in designing a new type of survivable communications for periods of severe ionospheric disturbance. Objective - to study ionospheric absorption/reflection of VLF/ELF signals by rocket-borne experiments at various geomagnetic latitudes, and ionospheric conditions. To determine the existence of ELF windows in the ionosphere. How research contributes - provides vital information on Doppler shifts, group delay, etc., of VLF/ELF radio waves resulting from interaction with the ionosphere.

Rocket-borne payloads are used to study terrestrial VLF/ELF radio signals, which impinge on the ionosphere, and are partially reflected and partially transmitted. The transmitted wave absorption losses due to collision in the ionosphere will be investigated. Data will be used in feasibility studies in the development of aerospace communications, navigation and timing signals in this frequency range. From field strength and polarization measurements, propagation models will be evolved, and used with full-wave computer programs for prediction purposes.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0027, HARDENING TECHNIQUES

S.B. HERSKOVITZ, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF244950)

AF function - advanced weaponry. Deficiency - laser radiation can cause damage to aerospace vehicles. Objective - to provide means of minimizing damage via measurement of laser-induced breakdown of particles and gases. How research contributes - studies effects of laser radiation on aerosol particles.

The presence of specific particles can substantially lower the laser-induced breakdown threshold of the atmosphere. Once formed, this plasma can be maintained by absorbing energy from the incident laser radiation. Work is directed toward producing aerosols which will protect surfaces from laser damage by intercepting and dissipating the incident energy.

ADDENDA: Supporting Agency Address is: AF Cambridge Research Laboratories, LZ, L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0028, BASE MOUNTED ANTENNA RESEARCH FOR REENTRY VEHICLES

J.F. LENNON, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF900440)

AF function - weapons delivery. Deficiency - antenna performance on reentry vehicles is compromised if antennas are mounted on the side of the vehicle. Objective - to determine through laboratory measurements and flight-test experiments the effect of reentry ionization on base mounted antennas. How research contributes - base mounted antennas are being considered for use in arming and fuzing applications. The present research would provide fundamental knowledge on the operation of such antennas during reentry.

Windowless antennas depend for their operation on the critical phase and amplitude balance of the radiation from several antenna elements. The detuning effect of the near wake ionization will be determined by measuring the element impedances, and radiation characteristics will be measured in the laboratory (in-house) in an arc jet-wind tunnel experiment (M.I.T.), and finally in actual flight.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0029, DUAL-BAND ARRAY TECHNIQUE

R.J. MAILLOUX, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF900700)

AF function - aircraft-to-satellite communication and other aircraft flush-mounted applications. Deficiency - improved antenna performance is required particularly to achieve independent beams at widely spaced frequencies. Research - investigation of new antenna techniques for dual-band array elements. How research contributes - most present array techniques allow only one beam to be scanned at one given frequency. The several exceptions that do allow dual independent beams have relatively low aperature efficiency. New dual-band array techniques would allow lightweight arrays with efficient use of the aircraft mounting space.

The approach is to investigate the properties of a particular kind of dual-band phased-array technique that used dielectric slab-loaded waveguide elements to provide separate control of two widely spaced frequencies.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0030, EVALUATION OF THE RADIATION TOLERANCE OF INTEGRATED INJECTION LOGIC

W.M. SHEDD, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF247040)

AF function - weapons delivery, communications of Air Force space and missile systems. Deficiency or opportunity - current Air Force radiation hardness requirements are not being met. Objective - to evaluate the radiation tolerance of integrated injection logic in the various radiation environments required by Air Force systems. How research contributes - the significant electrical performance advantages of integrated injection logic, including increased speed, reduced power and increased packing density, cannot be made available to Air Force systems until the radiation tolerance of this technology is established and if necessary improved.

Samples of integrated injection logic integrated circuits will be obtained from various manufacturers along with the pertinent device geometries and fabrication procedures used in the manufacture. Complete electrical evaluation of these units will be made before radiation exposure to establish their performance and to serve as a base line for the changes in electrical performance resulting from subsequent radiation exposure. The devices will be exposed to the various radiation environments required by current Air Force systems specifications. These exposures will be made as a function of radiation dose and dose rate in order to determine the sensitivity of device degradation to each nuclear radiation environment (neutron, total gamma dose, and dose rate). The electrical performance of the devices will be evaluated after exposure at each radiation dose level and the changes

in device performance will be correlated to the device geometries and material properties to obtain an understanding of the degradation mechanisms. As a result of these experiments the tolerance of the devices to radiation will be determined and possible methods for improving this tolerance will be recommended. In particular, recommendations on the applicability of these devices for use in Air Force systems with different radiation requirements will be made.

ADDENDA: Supporting Agency Address is: AF Cambridge Research Laboratories LQ, L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0031, LASER IRRADIATION OF INFRARED TRANSMITTING MATERIALS

L.H. SKOLNIK, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF900470)

AF function - development of materials which are laser hardened. Deficiency - lack of information regarding laser-induced reradiation effects. Development - study of real-time laser reradiation effects in IR dome materials. How development contributes - suggests mechanisms for hardening of IR dome materials against hostile laser threats.

Previous studies have identified many missile and aircraft components which are vulnerable to either mid-infrared or far-infrared high-power lasers. This study will focus on the real-time measurement of laser-induced reradiation in infrared dome materials of heat-seeking missiles. Specifically, an infrared vidicon system will be developed which is sensitive to radiation in the 2-5 um region. This system will then be used to evaluate the effects of high-energy CO2 laser radiation on IR dome materials with a view towards suggesting appropriate countermeasures. The system will also permit real-time heat flow analysis in laser-irradiated domes and windows.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0032, SURVIVABILITY AND LASER HARDENING OF ELECTROOPTICAL AND ELECTRONIC COMPONENTS

L.H. SKOLNIK, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF901810)

AF function - surveillance, reconnaissance, navigation, tactical warfare. Deficiency - inability of present Air Force systems to remain functional in a hostile laser environment. Objective - to determine the infrared optical properties of materials with potential for reflective IR dome coatings, based on lattice vibration or free carrier reflectivity spectral phenomena. Such coatings may serve to substantially reduce out-of-band laser threats. To establish effective optical design methods for multilayer reflective coatings. How research contributes - specifies optical systems modifications which will reduce laser vulnerability of systems, thus extending mission operational capabilities.

The infrared reflectivity and transmission spectra of a variety of potential single- and multi-layer coated IR dome materials will be calculated and evaluated in terms of optimum signal transmission and out-of-band laser threat reduction. Materials under consideration are boron nitride, aluminum nitride and other compounds or mixtures of compounds with lattice vibrations near 10 micrometer and heavily doped gallium arsenide (n-type) with free carrier reflectivity onset in the same wavelength region.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0033, DESIGN OF AEROSPACE EXPERIMENTAL INSTRUMENTS

J.S. ROCHEFORT, Northeastern University, School of Engineering, *Boston, Massachusetts* 02115 (DF242400; F19628-76-C-0256)

AF function - nuclear weapons delivery, communications, detection, track and intercept. Deficiency - inability to forecast atmospheric interactions affecting the design and operation of military systems such as reentry vehicle, over-the-horizon radar, polar communications and satellite ephemerides. Research - to increase ability to forecast atmospheric variables requires measurements by sounding rocket and satellite experiments. How research contributes - provides instruments for conducting experiments measuring the composition and densities of ion and neutral species of importance to AF systems operations. Research, development and test of components and assemblies are undertaken to create reliable operating instruments for rocket and satellite experiments.

Contractor will design and prepare electronic instruments for mass spectrometer and related experiments as required for a series of rocket- and satellite-borne ion and neutral atmospheric composition measurement programs. The design of each experiment will be coordinated with parallel laboratory and other related programs while being updated according to the results of the preceding experiment.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory LK L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0034, INFLUENCE OF SECONDARY FLOWS AND ROTATIONAL EFFECTS ON TURBINE ENDWALL AND SHROUD HEAT TRANSFER

J.F. LOUIS, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF459640; F33615-76-C-2018)

To quantitatively identify heat transfer mechanisms present in high-performance turbine blade passages. To generate and test new film cooling configurations and provide useful turbine cooling design data for future systems. Identification of the factors controlling heat transfer mechanisms will result in increased component life and better gas turbine performance.

Investigate analytically and experimentally the influence of secondary flows arising from distorted pressure and temperature profiles on heat transfer to turbine endwall and shroud. Investigate the combined effects of secondary and centrifugal effects on shroud. Use results to design optimum cooling configuration of wall and shroud.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0035, HF SIGNAL PROCESSING ANALYSIS

V. RAJAN, Boston College, Graduate School, *Chestnut Hill, Massachusetts* 02167 (DF900880; F19628-76-C-0006)

AF function - long-range detection. Deficiency - auroral clutter severely degrades OTH radar performance. There is insufficient knowledge on the structure of these irregularities. Research - to characterize the temporal and spatial structure of auroral irregularities responsible for clutter on high-frequency OTH radar systems. How research contributes - this effort will result in a detailed description of the structure of auroral irregularities. This information is necessary for the design and operation of OTH radar systems and will allow adaptive signal-processing techniques to be developed which will improve the performance of these systems.

Use available data with specifically prepared computer programs for analyzing the Doppler and angular spectra of aurorally propagated signals. Develop programs to analyze the statistical structure of the received noise and clutter. Previously developed computer programs for automatic processing of vertical HF ionograms will be extended to include high-latitude ionograms and will be applied to the technique to processing of topside ionograms.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0036, MODAL STRUCTURES

E.C. DUNTON, Barkley & Dexter Labs. Inc., *Fitchburg, Massachusetts* 01422 (DF246870; F19628-76-C-0164)

AF function - command/control communications. Deficiency - survivability of long-range emergency communications systems. Objective - to obtain transverse electric and transverse magnetic polarization data of manmade and natural sources. How research contributes - provides information concerning the use of transverse electric waves for improving air-to-air communication range.

Carry AFCRL TE/TE dartsonde packages to high altitudes, then release and allow to free fall. During flights packages telemeter data to a ground receiving station.

ADDENDA: Supporting Agency Address is: AF Cambridge Research Laboratories LI, L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0037, MODAL STRUCTURES
E.C. DUNTON, Barkley & Dexter Labs. Inc., *Fitchburg, Massachusetts* 01422 (DF901140; F19628-76-C-0164)

AF function - command/control communications. Deficiency - survivability of long-range emergency communications systems. Objective - to obtain transverse electric and transverse magnetic polarization data of manmade and natural sources. How research contributes - provides information concerning the use of transverse electric waves for improving air-to-air communication range.

Carry AFCRL TE/TM dartsonde packages to high altitudes, then release and allow to free fall. During flights packages telemeter data to a ground receiving station.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0038, HIGH-LATITUDE IONOSPHERIC STABILITY AT VERY LOW FREQUENCY
R.C. KAHLER, Barkley & Dexter Labs. Inc., *Fitchburg, Massachusetts* 01422 (DF901660; F19628-76-C-0085)

AF function - command/control communications. Deficiency - survivability of long-range emergency communications systems. Objective - to obtain data on the reflectivity of the lower ionosphere at high to low and very low frequency radio waves, with particular emphasis on frequencies below 15 KHz. How research contributes - provides the experimental information required to evaluate the reliability of communications in the lower portions of the VLF spectrum under disturbed ionospheric conditions.

This contract will study the amplitude and phase stability of ionospherically reflected waves in the lower VLF spectrum, ranging from 3 to 15 KHz. The measurements will be conducted in northern Greenland using AFCRL's high-resolution pulse ionosounding system over path lengths from 100 km to 1500 km and with ground conductivities from 2x10 to the minus 5 mho/m to 4 mho/m. Reflection coefficients for frequencies between 4 and 8 KHz will be determined and presented as a function of zenith angle.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0039, DESIGN AND FABRICATE INSTRUMENT TO MEASURE ELECTRON AND PROTON FLUXES
F.B. SELLERS, Panametrics Incorporated, *Waltham, Massachusetts* 02154 (DF242880; F19628-74-C-0217)

AF function - communications and reconnaissance. Deficiency - unknown cause of erratic system performance. Research - develop instrument to measure electron and proton fluxes in .05-300 KeV energy range. How research contributes - this instrument will be used in the SCATHA satellite as one of a number of sensors intended to define the particle and field environment at synchronous orbit and its effect on satellite performance. It involves the design and testing of feasibility models and the fabrication of flight instruments and associated GSE. Instrument will feature maximization of information and minimization of weight, power requirements and telemetry demands.

Initial design work has been started. An experimental set-up for detecting UV transmission through different ESA plot configurations is being constructed. A Monte-Carlo computer program is also being utilized to optimize the ESA detector geometry for maximum efficiency and to determine relevant design parameters.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory PH L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0040, PREFERENTIAL ICING ON BRIDGES - APPLYING HEAT PIPE TECHNOLOGY TO THE DEICING OF BRIDGE DECKS
UNKNOWN, Grumman Corporation, *Bethpage, New York* 11714 (FH-55553, FH-11-8545)

The objective of this project is to develop a bridge deck heating system that will eliminate high maintenance and safety costs associated with preferential icing phenomenon.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

4.0041, FINITE-ELEMENT TECHNIQUES FOR AERODYNAMIC COMPUTATIONS OF COMPLEX CONFIGURATIONS
S.F. SHEN, Cornell University, School of Aero. & Mech. Engin., *Ithaca, New York* 14850 (DN223121; N00014-75-C-0375)

The development of accurate and rapid methods for the prediction of the flows about complex configurations is essential for the design and optimization of naval aircraft and missiles. This task will provide for a systematic study of finite-element methods as applied to such flows.

The computation of the flows about complex configurations in aeronautics now tax, and will continue to tax for the foreseeable future, the capabilities of the most advanced computing machines. Hence there is a continuing need to explore and develop new and more efficient methodologies for complicated flows. The major numerical method to date has centered about finite difference approximations to the governing partial differential equations. Alternate procedures are being developed based on finite-element approximations, approximations which appear to be more practical for complex geometries. These finite-element methods may or may not employ variational principles. This research will systematically examine various aspects of the finite-element method. Initially, inviscid incompressible flow will be studied, utilizing a variational principle, with emphasis on the body geometry. These results will be assessed against exact solutions. The major emphasis will be devoted to a study of inviscid compressible aerodynamic problems including transonic flows.

ADDENDA: Supporting Agency Address is: Office of Naval Research Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0042, DYNAMIC, CONTROLLED TRI-GAS MIXING DEVICE FOR DELIVERY OF BREATHING GASES
A.J. SIPIN, Anatole J. Sipin Company, *New York, New York* (DF315950; F41609-73-C-0028)

Future aircraft oxygen (O2) delivery systems may deviate considerably from present conventional techniques of providing crew members with supplemental O2 at altitude. Two concepts are of particular interest to the Air Force since they both reduce O2 wastage and, therefore, are compatible with the revolutionary idea of in-flight O2 generation. Systems which will selectively capture O2 from jet-engine bleed air and supply it to crew members will eliminate expensive liquid and gaseous O2 logistical support at 'bare base' operations. The two concepts of O2 delivery which require additional experimental testing are phase-dilution and closed-loop breathing systems from the standpoint of O2 conservation and physiologic acceptability. A considerable segment of the needed research calls for experiments in which human subjects will breathe high concentrations of O2 pre-mixed with exact amount of carbon dioxide (CO2). Other studies will require that accurate mixtures of O2 and nitrogen (N2) or O2, N2 and CO2 be supplied to subjects at high flow rates. This effort provides a system for use within various work units under Task 7164-17.

Presently, two methods exist for supplying various mixtures of these gases to test subjects. Both methods are very expensive in terms of money and/or manpower. They are: 1) establishing the desired gas mixture in large environments, and 2) buying high-pressure cylinders of specially analyzed pre-mixed gases from commercial suppliers at high cost and, usually, less than desirable accuracy. To circumvent the problems associated with present methods of supplying gas mixtures to subjects in future planned experiments, the construction of an automatic, dynamic 3-gas mixing device is proposed. Basically, the system would very accurately prepare mixtures of 2 or 3 gases in any combination using automatic feedback control of variable-orifice lines to banked high-pressure cylinders of 100 percent O2, N2 and CO2. The mixed gases would be directed to a suitable reservoir from which the subject could breathe at flow rates up to 250 l/minute, which qualifies the unit for exercise studies. The system would also have the capability of delivering 100 percent O2 at very low flow resistance, thus eliminating the potential fire hazard associated with the exposure of men to hyperoxic chamber environments. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0043, RADAR COMPONENT COST STUDY

A.S. CARDELLO, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13442 (DF742860)

This is an in-house program aimed at developing criteria for evaluating the use of solid-state and tube amplifiers in radar and communication systems. The cost relationship between frequency of operation, device availability, device power level and life-cycle costs will be determined for devices used in a variety of ground-based systems. This effort will be a supplement to Contract F30602-75-C-0142, entitled Cost-Effective Solid-State Transmitter Study.

A survey will be conducted of on-shelf solid-state power amplifiers and tubes in order to establish what is available in terms of power, pulse width, duty, frequency and cost. A prime objective will be to determine cost in dollars per watt as a function of (a) frequency from 10 MHz to 10 GHz, (b) peak and average powers in individual packages and what is attainable in practical combining techniques, (c) various transmission modes, such as long pulse with coding, short pulse, saturated CW and linear versus SSB application. The study will not be limited to amplifiers but will catalog and identify components such as circulators, combiners, phase shifters, antenna elements and power supplies as well as power distribution schemes. Included in the study will be attempts to determine those areas where development is required in order to advance the state of the art in regard to increasing power, efficiency and gain at the frequencies of interest. The cost-evaluation study will include the effects on cost of procurement of a number of devices up to quantities of 5 and 10 thousand. Trade-off analyses will be performed to determine the optimum power per device versus the cost of lower power devices combined to achieve a required level per module package. The end item will be a final report which will aid in determining the pacing cost items in system design at UHF, L-band and S- band. Charts, nomographs and projections which are capable of being updated periodically will be included.

ADDENDA: Supporting Agency Address is: Rome Air Development Center OCT, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0044, COMMUNICATIONS - GROUND ANTENNA DEVELOPMENT

J.A. GRANIERO, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13442 (DF707750)

The objective of this effort is the study and experimental verification of antenna subsystem characteristics developed to meet the requirements of future ground-based military communications systems. Characteristics of adaptive phased arrays and dielectric lenses, emphasizing application to microwave communications and command and control of remotely piloted vehicles (RPVS), will be investigated.

Requirements imposed by various microwave communications systems and RPV command and control systems will be determined through paper studies. Areas where phased arrays or dielectric lenses can uniquely alleviate or solve problems will be determined. Designs will be developed and verified for these applications. In-house and contractual efforts have shown phased arrays to be a good choice for a ground-based communications antenna for various microwave links and RPV command control. An adaptive computer controlled array will be checked experimentally for compatibility with these systems.

ADDENDA: Supporting Agency Address is: Rome Air Development Center DCC, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0045, NONLINEAR CIRCUIT SYNTHESIS TECHNIQUES

J. SPINA, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13442 (DF736560)

The objective of this effort is to develop design procedures to minimize nonlinear effects in mildly nonlinear circuits. Specifically, design procedures that will reduce nonlinear distortions such as intermodulation, desensitization, gain compression, etc., in amplifier circuits will be explored.

The approach to be used is one that relies on reducing in-band nonlinear distortion products by modifying the first-order transfer functions outside the band of interest. The technique to be used makes use of the fact that certain high-order nonlinear effects in the passband are functions of first-order network parameters at frequencies outside the band; by appropriate modification of these first-order parameters, in-band nonlinear effects can be reduced.

ADDENDA: Supporting Agency Address is: Rome Air Development Center RBC, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0046, MULTIPLE SIDELOBE CANCELLER EVALUATION

K.C. STIEFVATER, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13442 (DF742890)

The objective of this effort is to conduct a complete and extensive evaluation of the multilevel and adaptive beamport sidelobe cancellation techniques in a multijammer environment. These techniques have been developed to overcome the severe problem of unequal power jammers being received in the reference antenna and in the sidelobes of the main antenna. The two techniques employ different methods of separating the strong and weak jammers, which are then processed independently. The multilevel sidelobe canceller employs amplitude separation and the adaptive beamport sidelobe canceller utilizes spatial separation.

The contractor-delivered equipment will be integrated into the signal-processing laboratory located at RADC and subjected to narrow- band CW jamming and FM modulated CW jamming. Preliminary test will be conducted using one, two and three jammers located in adjacent buildings and in mobile vans to simulate the multijammer environment. When the equipment has been checked out and is performing properly, flight tests will be scheduled to provide realistic data from airborne jammers. In addition to the evaluation of the electrical performance, consideration will be given to the relative compatibility of this technology with existing tactical radars such as the AN/TPS-43.

ADDENDA: Supporting Agency Address is: Rome Air Development Center OCT, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0047, HYBRID PACKAGING OF INTEGRATED CIRCUITS

H. KAST, General Electric Company, *Cincinnati, Ohio* 45215 (DF457320; F33615-74-C-2070)

Develop improved hybrid electronic microcircuit modules for hard- mounting on, and ultimate control of, gas turbine engines. The modules are to be packaged in such a way that common mechanical failures of electrical components are obviated.

This is a 30-month program in which the following seven tasks will be performed: 1. Selection of control module, 2. Design and fabrication, 3. Procurement of IC chips, 4. Complete hybrid

assembly, 5. Bench testing, 6. Engine testing, and 7. Preparation of a final technical report.

ADDENDA: Supporting Agency Address is: AF Aero-propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0048, ADVANCED TURBINE ENGINE CONTROLS COMPONENTS

H.B. KAST, General Electric Company, *Cincinnati, Ohio* 45215 (DF456570; F33615-74-C-2007)

Under this program, a sensor and an interface development effort are taking place. The objective for the sensor development is to develop a high-temperature absolute magnetic shaft encoder (position sensor) and to demonstarte the functional and operational capability of the encoder within the turbine engine environment. The objective for the interface is to design, develop, and test an electrohydraulic servovalve with fail-fixed features.

Each component developed will be bench tested to demonstrate functional capability and engine tested to verify operational integrity.

ADDENDA: Supporting Agency Address is: AF Aero-propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0049, SEMICONDUCTOR MEMORY CONCEPTS

R.A. BELT, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF080060)

The operational performance, size and cost specifications, and radiation-hardening capabilities of present semiconductor memory technologies must be extended to meet advanced AF systems needs in the areas of radar data processing, navigation and guidance computers, ECM, communications, reconnaissance, and weapons delivery. The objective of this in-house basic research program is to evaluate semiconductor memory concepts of potential applicability to AF needs, to devise specific device implementations and related processing procedures for these concepts, to establish operational feasibility of the devices, and to study unique phenomena associated with the operation and fabrication of memory devices.

New semiconductor memory device structures will be designed and tested for operational feasibility. Associated new and/or modified processing requirements will be developed and reviewed for compatibility with conventional semiconductor processing. Operational parameters will be investigated both theoretically and experimentally. Fundamental physical phenomena inherent to the device concepts such as crystalline-polycrystalline interfacial characteristics, charge transport, growth kinetics and electrooptic properties of the semiconductor and insulator materials will be studied and characterized.

ADDENDA: Supporting Agency Address is: AF Avionics Laboratory DHE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0050, PERFORMANCE TESTS OF HYDRAULIC POWER TRANSFER UNITS

J. DELL, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF457430)

To conduct performance tests on rotary and oscillating piston-type power transfer units to provide comparison data for future hydraulic system applications. Specific areas to be emphasized are breakout pressures, stability, noise, pulsations, and efficiency.

A rotary-type power transfer unit presently used on the C-5 aircraft has been purchased and will be tested in a special test setup to be fabricated in Room 16, Building 18. A prototype oscillating piston power transfer unit, which is a delivery item under contract F33615-72- C-1078, will then be tested under identical conditions using the same test setup.

ADDENDA: Supporting Agency Address is: AF Aero-propulsion Laboratory POP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0051, EXCITATION STUDIES AND MASS SPECTROMETRY OF PLASMAS

J.W. DETTMER, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF458830)

AF function - communication, weaponry, illumination, RF effect in communications, nuclear weapons effects. Deficiency - lack of knowledge on excitation, ionization and dissociation processes in gas-discharge lasers and the upper atmosphere, especially under energetic conditions. Research - mass analysis of gas discharges relevant to molecular gas- discharge lasers. Direct and cumulative excitation cross sections. How research contributes - improved gas-discharge laser systems and improved understanding of atmospheric processes.

A modulated molecular beam mass spectrometer is used to monitor the relative and absolute concentrations of various molecular species existing in typical laser plasmas. Neutral, ionic, and reactive species are measured under carefully defined plasma conditions. Time-resolved observations of the species concentrations allows direct analysis of dissociation and association rates. Phase-sensitive detection of the modulated beam and use of a low-energy, efficient ionizer assures unambiguous measurement of the true plasma ions and neutral concentrations. Direct and cumulative excitations of atomic and molecular gases are measured using a dual electron beam system interacting with a molecular beam. A high-speed pumping system allows measurement of these cross sections in dissociating gases. Photon counting, synchronous detection, and sophisticated digital data-handling techniques are used to obtain and analyze reliable data. A low-energy electron analyzer permits direct measurement of elastic and inelastic scattering of electrons by atoms and molecules. This instrument has a resolution of better than 0.03 eV and is capable of resolving resonant states of atoms and molecules. Data from these experiments is used to improve existing theoretical models of non-equilibrium plasmas and to aid in the analysis of the plasma properties of discharge lasers. Direct and cumulative excitation and ionization measurements lead to a better understanding of the effects of natural and man-made ionospheric disturbances.

ADDENDA: Supporting Agency Address is: AF Aero-propulsion Laboratory POD, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0052, TRANSFERRED ELECTRON DEVICES

C.I. HUANG, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF099490)

Because of the significant impact offered by this device in the area of high-speed processing, it is advantageous to concurrently establish this in-house effort to support contractual efforts by studying the critical problem areas associated with GaAs material and processing parameters associated with the development of TEDs. The objective of this task will be to refine the design criteria for high- speed transferred electron device (TED) switches, and to investigate novel designs and fabrication techniques.

The design criteria presently used for fabricating TED high-speed switches are based on relatively crude theoretic treatments; this theory will be refined and modified where necessary to derive improved design criteria. The validity of these criteria will then be proven or disproven experimentally. Unique multi-terminal devices will then be fabricated and tested based on the improved design.

ADDENDA: Supporting Agency Address is: AF Avionics Laboratory DHM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0053, IN-HOUSE OPTICAL MULTIPLEX PROGRAM

E.N. HUMPHREYS, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF094640)

To provide the AF with an in-house capability to analyze, test, and verify feasibility of all phases of optoelectronic data transfer technology.

Design, fabricate, and test optimum optical and electrooptical interfaces, develop and test various approaches to fiber optic handling and repair, investigate input/output devices for the electrooptical data business in order to achieve system optimization,

and develop dynamic analyzer test program for testing optical and electrooptical components and systems in an operational environment.

ADDENDA: Supporting Agency Address is: AF Avionics Laboratory AAT, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0054, RPV IMAGERY LINK EVALUATION

F.T. HUTSON, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF097540)

The goal of this effort is to evaluate the effects of jamming on a jam-resistant video data link. The determination of these effects will enable us to specify the target acquisition and data transmission hardware required for the RPV strike mission.

We will investigate the effects of jamming on a jam-resistant video link using the following simulation: an in-house-constructed image processor will perform a spatial transform (e.g., Hadamard or Haar transform) and coefficient selection for bandwidth reduction in real time, on data from any of several possible sources of dynamic imagery. This reduced bandwidth data will be A-J modulated, converted to L- or X- band and will be jammed using the communications system evaluation laboratory equipment in AFAL/AAD. The data will be demodulated and displayed on a monitor to a subject controlling the motion of the imagery source. The imagery source motion will either be made to approximate the flight characteristics of a drone (using a computer flight dynamics model), or it may be a gimballed camera mounted on an AMRL drone test bed. The testing will involve observation of the subject's ability to control the imagery source motion over a wide range of jamming conditions.

ADDENDA: Supporting Agency Address is: AF Avionics Laboratory AAD, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0055, HYDRAULIC DYNAMIC ANALYSIS

P.D. LINDQUIST, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF455370)

The purpose of this program will be to model the dynamic effects of an aircraft hydraulic system. Computer models will be developed and verified in the laboratory.

The approach will be to set up, beginning with a simple system, a hydraulic circuit in the laboratory and develop an analytic model which can be verified.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory POP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0056, THERMAL ENERGY STORAGE AND HEAT TRANSFER INVESTIGATION

E.T. MAHEFKEY, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF458500)

To develop the required analytical and experimental heat transfer and metallurgical compatibility data necessary to optimize the design and useable life for surveillance spacecraft VM cryocooler applications.

A two-phase program is proposed. Phase 1 concerns analytical modeling of transient cycling of cylindrically encapsulated TES phase change materials, setting up an in-house test capability to allow thermal cycling of liquid metal heat pipes with integral TES, and initiating invacuo metallurgical clad/TES compatibility tests. Phase 2 centers on calorimetric testing and cyclic performance mapping of subscale thermal trains and contractual end-item hardware.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory POE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0057, DISPLAY TECHNOLOGY ASSESSMENT

W.H. NELSON, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF098370)

To determine the optimum display technologies to meet projected AF display needs. Recommendations will be made on the optimum cost/performance solutions with the possible initiation of technology programs to provide the technology base for the recommended display approaches.

Display requirements for A/C use will be determined through contacts with user and system organizations including ASD, AFFDL, AFAL/AAM, AFAL/(DAIS), AMRL, and other organizations and agencies. With the assistance of these organizations an attempt will be made to classify display requirements in terms of both operational and human factors requirements. Technologies being applied or planned for display use will be assessed through visits and literature evaluation. Technology will be assessed against specific requirements in order to determine the best match in terms of the optical and electrical display result, cost, and human factors, size, weight, power, availability and risk in development, and other relevant factors. Recommendations will be made to specify the optimum technology for specific applications and the technology advances that should be sought to best meet future display requirements.

ADDENDA: Supporting Agency Address is: AF Avionics Laboratory DHO Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0058, ION IMPLANTATION IN III-V COMPOUNDS

Y.S. PARK, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF104070)

AF function - avionics, communications, microwave generation and detection. Deficiency - Air Force avionics systems require basic electronic components employing semiconductors such as GaAs and other III-V compounds. Characteristics of ion-implanted III-V compounds are not well understood. Research - ion implantation of III-V compound semiconductors with the dopants which will alter electrical and optical characteristics of the materials. Study of the dopant profiles, damage profiles, atomic positions of the implanted dopants, surface contamination, interface conditions and annealing conditions; identification of defects in As-grown crystals. Applications of ion- implantation techniques to fabrication of waveguides, microwave devices and for electrical isolation of device structures. How research contributes - a deeper understanding of the results of ion implantation will provide a technology to improve the performance and operating characteristics of solid-state devices of III-V compounds and will provide better characterization and control of the intrinsic lattice defects introduced into the starting materials during crystal growth and subsequent device processing steps.

Selected group III-V compound semiconductors in bulk or epitaxial configurations will be ion-implanted or electron-bombarded. To characterize the implanted or electron-irradiated crystals, measurements of luminescence, electrical conductivity, Hall effect, photoconductivity, reflectivity and absorption are used. EPR, NMR and ENDOR are used to study the type of radiation damage centers created by ion implantation and electron bombardment. Ion-channeiing, Auger- electron spectroscopy, C-V measurements, electron emission spectrometry and Raman scattering are used to learn the depth profile and location of the implanted atoms.

ADDENDA: Supporting Agency Address is: AF Avionics Laboratory DHR Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0059, EVALUATION OF MODEL PRESSURE MEASURING DATA SYSTEMS FOR USE IN REENTRY VEHICLES SIMULATED IN GASDYNAMIC TESTING FACILITY

E.B. PETERS, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF130240)

Advance Air Force flight vehicles such as missiles and lifting bodies operate over a wide range of extreme environmental conditions. Simulating these conditions in ground test facilities requires determination of all the parameters affecting aerodynamic flow patterns. Aerodynamic simulations require a determination of the flow-induced pressure pattern about the simulated shape. A system capable of simultaneously measuring and transmitting thirty channels of model pressure data is envisioned. The objective of this in-house work is to improve the performance capabilities of the thirty-channel pressure system, to improve the quality of the pressure data and to reduce the overhead cost by standardization of the component modules.

Design studies will be conducted to define the problem areas in the pressure-measuring systems in all of the AFFDL gasdynamics test facilities. Several model pressure-measuring data systems design concepts will be field tested and evaluated for future pressure- measuring criteria. Technical memoranda of the performance evaluation and configuration control will be produced.

ADDENDA: Supporting Agency Address is: AF Flight Dynamics Laboratory FXNC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0060, B-BAY UPGRADE

D.C. RABE, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF458360)

The objective of this project is to upgrade the b-bay irradiation effects facility to produce output powers in the order of 25kw with good beam quality and to improve instrumentation of the system for complete diagnostics.

The approach will be to investigate the aerodynamic stabilization of the electric discharge in the CO2 gas laser and attempt to increase power input to the channel. Also gas cooling will be investigated to help decrease the entrance Mach number so increased flow rates and pressures can be obtained. Instrumentation will be provided as required for increased diagnostics.

ADDENDA: Supporting Agency Address is: AF Aeropropulsion Laboratory POD, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0061, MEMORY TECHNIQUES

F.L. SCHUERMEYER, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF093950)

The objective of this in-house development effort is the test and evaluation of all types of memory devices, such as metal-nitride-oxide semiconductor (MNOS), charge-coupled devices (CCD), and magnetic bubble mass memories. Degradation phenomena, margins, parameter variation with temperature and operating conditions, signal-to-noise-levels error rates, lifetime, timing diagrams, etc., shall be investigated. Typical devices from commercial vendors and Air Force developmental contracts shall be evaluated. This work is necessary to confirm contractor claims and provide guidance and consultation to system project offices. This effort will also be directed toward upgrading the MNOS technology.

Special exercises will be used for MNOS, CCD and magnetic bubble memory tests and evaluation studies. Commercially available Macrodata 100 and 104 memory testers shall be used for data pattern sensitivity and other array tests. These facilities will be utilized to test critical performance parameters for comparison to contractor's data. Interface and insulator doping will be developed to improve write speed and endurance of MNOS transistors.

ADDENDA: Supporting Agency Address is: AF Avionics Laboratory DHE Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0062, MICROELECTRONIC DESIGN AND FABRICATION

R.E. SETTLE, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF099500)

Custom thick-film microcircuits and custom-printed circuit boards will be built in an in-house facility. This in-house effort will help reduce the transition time between a technological achievement and prototype system demonstration and at the same time reduce the acquisition costs of prototype hybrid microcircuits and associated interconnections on a printed circuit board. Intimate knowledge of IC microelectronic materials is mandatory. This in-house facility will provide a prototype fabrication and test bed for proposed standard electronic modules for avionic systems. Also contractual achievements and progress evaluations can be made in-house to more accurately evaluate tradeoffs of present technology vs. anticipated (or reported) contractual gains. The AF benefit will be in more efficient use of the contract dollar and more concrete contract objectives being established. Many production yield problems can be predicted as a result of the fabrication of a relatively small quantity of prototypes and these problems can be eliminated before a production contract is awarded.

Specific needs within AFAL will be met initially in order to develop competency and to provide circuits aimed at demonstrating the in-house capability. Digital and linear circuits will be fabricated from commercially available ICS. These demonstrator circuits will be instrumental in obtaining supporting customers. Specific device needs of AF SPO, labs and other DoD agencies in the hybrid microelectronic spectrum will be designed and fabricated in prototype quantities. Microprocessors for radar and other applications, A/D and D/A converters, communication subsystems are a few examples.

ADDENDA: Supporting Agency Address is: AF Avionics Laboratory DHE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0063, SAR DATA ANALYSIS

J.P. SHANKLIN, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF097850)

To provide quantitative information on the smoothing effects of non-coherent integration of SAR data as functions of transmit frequency, azimuth angle, transmit-receive polarizations, flight path characteristics and target-background categories. The digital data used for fundamental radar parameter evaluation will also be investigated for other types of post-correlation radar processing such as polarization ratioing, azimuth and frequency discrimination.

SAR data from the polyfrequency radar which has been optically correlated and digitally recorded on magnetic tape will be the main data base for this study. This data will contain three multilook diversity dimensions consisting of four transmit frequencies by 15 azimuth aspects, by four transmit-receive polarizations. Multilook data will be digitally formed from this data base by non-coherent integration. Techniques such as polarization ratioing will also be investigated. This analysis will be done for a wide spectrum of hard targets and diffuse surfaces. The analysis will also be a function of depression angle, as well as depression and azimuth angle changes. The approach is more completely described in a detailed plan dated June 73, 'A Plan to Determine the Quantitative Effects of Frequency, Azimuth, and Polarization on Synthetic Aperture Imagery'.

ADDENDA: Supporting Agency Address is: AF Avionics Laboratory DHE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0064, IR THREAT WARNING RECEIVER CONCEPTS DEVELOPMENT PROGRAM

E. WISNIEWSKI, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF098240)

To provide the avionics lab with an independent test and evaluation capability for IR warning receivers.

Missile launch and separation will be simulated by movement of a beamsplitter transmitting the IR energy from two blackbody sources onto an off-axis parabolic collimator. Signal-to-noise ratio and sky background can be simulated by controlling the temperature of a screen or fluid tank covering the field of view of the IR sensor.

ADDENDA: Supporting Agency Address is: AF Avionics Laboratory WRP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0065, STIMULATED ANTI-STOKES RADIATION IN GASES

R.B. WON, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF458860; F33615-75-C-1116)

AF function - laser development, combustion studies, compressor studies, chemical emissions, aerodynamic testing. Deficiency - on-site methods are needed to determine temporally and spatially resolved species concentrations in reacting and non-reacting flows. Research - development of an experimental and theoretical base for the applications of stimulated anti-Stokes

spectroscopy to the measurement of species concentrations in plasma and gases. How research contributes - a recent experimental test at Onera, France, showed that stimulated anti-Stokes radiation can be used to measure the density of molecular hydrogen in reacting flows. The intensity of this radiation was many orders of magnitude greater than the radiation produced by ordinary Raman scattering. This new approach will be investigated and extended to include other molecules of interest to the Air Force.

The measurements at Onera were restricted to H sub 2 because the high-intensity Stokes radiation was generated in high-pressure hydrogen cells. To extend the method to other species, high power, tunable lasers will be used to generate the Stokes beam at the required frequency for given molecular species. Several systems will be designed based on available pump and tunable lasers. An assessment will be made of the applicability of these systems to current Air Force Research and Development programs. Coordination of this program has been made with other AFSC laboratories. The Plasma Physics Laboratory, ARL and AFAPL plan a joint effort applying these research results in FY76.

ADDENDA: Supporting Agency Address is: AF Aero-propulsion Laboratory POP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0066, SUPERCONDUCTING GENERATOR FOR AIR-BORNE HIGH-POWER APPLICATIONS

J. PARKER, Westinghouse Electric Corp., *Lima, Ohio* 45802 (DF452320; F33615-71-C-1591)

Development and test of a lightweight megawatt-class superconducting AC generator. The program will demonstrate the feasibility of high-power superconducting generators for airborne applications.

The program consists of three phases: (1) analysis, preliminary design and critical component test--full-scale rotor test, seal tests and superconducting material tests will be accomplished in this phase; (2) extended seal and rotor testing, detail design and machine checkout; (3) phase 3 contains performance verification tests, two 24-hour tests of continuous operation at 1 mva with 0.8 pf lagging and 10-second pulses of 5 mva. At least 10 pulses will be imposed during each 24-hour run. Duration between pulses will be 1 - 3 minutes.

ADDENDA: Supporting Agency Address is: AF Aero-propulsion Laboratory POD, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0067, COMMUNICATIONS - D-REGION MEASUREMENTS

A.J. FERRARO, Penn. State University, School of Engineering, *University Park, Pennsylvania* 16802 (DN023240; N00014-75-C-0178)

The ultimate objective of this research is a better understanding of the D-region ionosphere during ambient conditions and under disturbed conditions, both natural and bomb-produced. A thorough understanding of the D-region is of great importance to existing and proposed naval communications and navigation systems that operate at VLF. It is of critical importance to those VLF systems which depend on phase and/or amplitude stability for their operation.

Classify diurnal and seasonal control of the D-region electron density profiles, deduce the signature of atmospheric gravity waves in the D-region from cross-modulation data, and complete adaptation of the ionospheric profile inversion technique and computer code for use with cross-modulation data.

ADDENDA: Supporting Agency Address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0068, EDGE FUNCTION METHOD OF STRUCTURAL ANALYSIS

P.M. QUINLAN, Natl. University of Ireland, *Cork, Republic of Ireland* (DF289360; AF-AFOSR-2768-75)

AF function - structural design/analysis of aerospace vehicles. Deficiency - present inability to mathematically represent large structural sections in an efficient, inexpensive fashion. Present detailed analysis methods are applied primarily to structural details, areas of high stress concentration, etc. Research - Prof. Quinlan is currently developing the edge function method for boundary-value structural analysis problems. In addition to his own research, he has access to data from other agencies and institutions on the application of the edge function method to specific areas such as vibration, thick plate, and fracture problems. His recent work in extending the analysis technique to the 3-D case promises to be a significant technical achievement and could be of great value to the structural design/analysis task. How research contributes - could provide an alternative, and much less costly, method of mathematically describing complex, large-scale, structural assemblies.

Mathematical parameters for the edge function method will be defined. Conditions under which the method can be applied will be obtained.

ADDENDA: Supporting Agency Address is: European Office of Aerospace Research & Development NRE, Box 14, FPO New York NY 09510

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0069, NAVY VEHICLE DESIGN AND CONSTRUCTION - SEPARATED VORTEX FLOWS ON THIN SWEPT WINGS IN INCOMPRESSIBLE FLOW

B.M. RAO, Texas A & M University System, School of Engineering, *College Station, Texas* 77843 (DN475137; N00014-75-C-0255)

To develop a non-linear three-dimensional theory for predicting flows over wings of moderate aspect ratio with separated leading edge vortices. Emphasis will be placed on the development of techniques for delaying the occurrence of vortex breakdown at the wing's trailing edge until higher incidence.

A non-linear analytical/empirical lifting surface theory for delta wings will be developed. This theory will account for wake effects, vortex curvature, burst vortex location and dissipative effects. Wind- tunnel tests utilizing a unique steam and liquid nitrogen flow visualization technique will be conducted on delta wings of aspect ratios 3 and 4 as well as a wing typical to current Navy fighter aircraft to provide required empirical factors and an understanding of separated vortex flows. The theory will be extended to a canard-wing configuration in steady flow and delta wing configurations in oscillatory flow.

ADDENDA: Supporting Agency Address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0070, HYBRID POWER SOURCE FOR ELECTRIC PROPULSION

J.B. OSULLIVAN, U.S. Army, Electrochemical Division, *Fort Belvoir, Virginia* 22060 (DA0K3768)

To evaluate the advantages of a hybrid power source (fuel cell- battery) for electric propulsion. The immediate application to benefit from increased efficiency and reduced emissions is material-handling equipment in enclosed areas. Information on cost, maintenance, performance, and efficiency is required in decisions regarding broader military application. Goals for FY76/77 are (1) redesign of regulator for fuel cell-battery control, (2) redesign of fuel control system, (3) installation and testing on the power source, and (4) design of 72V system for more rigorous applications.

Lab testing of the power source will use a high-power power supply driven by the analog signals from the field-recorded magnetic tape. Vehicle and power source performance will be monitored during field testing with the same instrumentation developed for measurement of load profile data.

ADDENDA: Supporting Agency Address is: MERADCOM, Electrochemical Division, Ft. Belvoir, VA 22060

SUPPORTED BY U.S. Dept. of Defense - Army

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, STANDARDIZED FOREST CONDITION CLASSES FOR AERIAL FOREST INVENTORY

E.W. JOHNSON, Auburn University, Agric. Experiment Station, *Auburn, Alabama* 36830 (0005688; ALA00909)

OBJECTIVE: Establish a set of standard forest condition classes which can be identified on standard USDA aerial photographs and determine the rate of error of identification of these classes when the identification is made by typical forest management personnel. Determine whether the composition of these classes is sufficiently consistent that standard stand tables can be used, along with light on- the-ground checks, to obtain reliable volume estimates.

APPROACH: An array of forest cover condition classes will be defined in terms of species composition, tree size, and stand density. A dichotomous identification key will be developed to permit classification of forest stands imaged on conventional USDA aerial photography. The ability of typical foresters to use the system and the key will be tested. This will be done by physiographic regions within the state. If the rate of error is 10% or less, plots (both fixed- radius and prism) will be established in the classes and data obtained for the construction of stand and stock tables.

PROGRESS: The Key for the Mountain Region has been printed. The field work for the Ridge and Valley Region is complete. Cover type descriptions and site relations are being developed. Four zones within the region have been defined and mapped. Field work in the Cumberland Plateau Region is essentially complete. Preliminary analyses of these data have begun.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0002, MATERIALS SUPPORT TECHNOLOGY - POLYMERIC THERMISTORS

H. FREISER, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (DN223349; N00014-75-C-0400)

Sensors and detectors are needed by the Navy for a variety of uses such as monitoring atmospheres for contaminants and remote detection of changes in the concentration of species in water and other media. This research concerns ion-selective electrodes comprised of polymer-coated wires which measure directly the concentration of specific ionic species in air or in water. The purpose of this study is to investigate the nature of these systems in order to improve the sensitivity and selectivity of these detectors.

This work deals with the elucidation of the nature of electrical charge conductivity in filled polymers and electrochemical behavior of polymer-coated electrodes and their application to analytical problems. Data will be analyzed in terms of electrode chemical composition vs. response characteristics in order to systematize the development of new kinds of detectors.

ADDENDA: Supporting Agency Address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0003, REMOTE SENSING RELATED TO THE FOREST ENVIRONMENT (FIR, FSUR)

R.C. ALDRICH, U.S. Dept. of Agriculture, Pac. S.W. For. & Rg. Exp. Sta., *Berkeley, California* 94701 (0021939; PSW-2251)

OBJECTIVE: Study energy radiation patterns of resource and environmental components, and develop remote-sensing technology to meet data needs for resource management.

APPROACH: Assess and adapt sensing techniques for resource inventories emphasizing small-scale imagery and photo measurements. Study photographic, photographic IR, and thermal portions of spectrum for recognizing stress in vegetation. Includes histology of needles, transpiration, and heat measurements of healthy and dying trees. Develop target signatures from reflectance associated with shadows, ground cover, sun angles and polarization effects. Exploit measurement devices such as aerial films, cameras, and microdensitometers. Explore techniques for automated image interpretation.

PROGRESS: ERTS bulk color composites revealed 79 percent of the interchanges between forest and nonforest land, timber cutting areas, and natural disturbances in Carroll County, Georgia. Best seasons for detecting disturbances were late fall and late spring. Enlarged ERTS images are helpful for broad land-use planning and detecting changes down to a 5-acre minimum. However, spatial position of objects can often be in error by 500 meters and low resolution obscures forest roads and forest damage.

SUPPORTED BY U.S. Dept. of Agriculture - F.S.

5.0004, STUDY OF APPLYING NOVEL REMOTE-SENSING TECHNIQUES TO ADVANCE THE STATE OF ARCHEOLOGY IN EGYPT - SPECIAL FOREIGN CURRENCY AWARD (ABBREV)

L.T. DOLPHIN, Stanford Research Institute, *Menlo Park, California* 94025 (INT76-00414)

This project will apply newly developed remote sensing techniques to advance the state of archaeology in Egypt. The main objective of the work is to further the state of knowledge in Egyptian archaeology by supplying archaeologists with maps, graphs, and data in advance of digging at selected sites. The work will be carried out jointly by scientists from SRI, AIN-Shams University and the Egyptian Organization of Antiquities. It would include the search for the tombs of Alexander the Great, Imhotep, and one or two Pharaohs believed to be buried in the Valley of the Kings.

To implement these archaeological explorations, the investigators plan to apply several advanced techniques, including: (1) electromagnetic-induction probe, (2) resistivity survey instrumentation, (3) magnetometry, (4) aerial infrared scanner, and (5) microgravity.

The proposal projects a two-phase effort. Phase I involves preparation and planning, and Phase II consists of the field- measurements program and data analysis. SRI and Ain-Shams University scientists will conduct systematic grid surveys at the chosen sites over a time period of approximately two months.

SUPPORTED BY U.S. Natl. Science Foundation

5.0005, CONSTRUCTION OF A DATA HANDLING AND COMMAND SYSTEM FOR A BALLOON-BORNE POSITIVE OR NEGATIVE ION MASS SPECTROMETER 13816-GS

R.C. AMME, Univ. of Denver, School of Arts & Sciences, *Denver, Colorado* 80210 (DA0X5577; DAAG29 76 G0113)

To observe for the first time the negative-ion component of the earth's atmosphere at 40 kilometers altitude. The work contributes directly to the BRL BMD Atmospheric Environment and Nuclear Assessment and Mitigation Program. The proposed measurements will also be used by other DoD agencies, including the Army Atmospheric Sciences Laboratory and the Advanced Ballistic Missiles Defense Agency.

Mass spectrometer studies of the upper atmosphere will be conducted in two phases. Phase one involves the design, construction, and testing of an RF quadrupole spectrometer package consisting of the quadrupole, its RF electronics package, pressure and temperature sensors, cosmic-ray ionization chamber, ultraviolet sensor, blunt-probe atmospheric conductivity unit, and tape recording and telemetering equipment. Phase two involves the balloon flight of this apparatus. The flight will be conducted in cooperation with the National Center for Atmospheric Research Balloon Facility at Palestine, Texas. Based on the observations, models of negative-ion content at 40 km will be developed. This study will complement positive-ion research already in progress.

ADDENDA: Supporting Agency Address is: DARCOM Army Research Office, Box 12211, Research Triangle Park NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

5.0006, COUPLING MECHANISMS WHICH PRODUCE IONOSPHERIC VARIATIONS FROM SOLAR AND TERRESTRIAL EVENTS

P.C. YUEN, Univ. of Hawaii, School of Engineering, *Honolulu, Hawaii* 96822 (ATM75-22641)

This grant funds continued research into the dynamic character of the ionosphere. The region near the magnetic equator exhibits many interesting variations including sudden subsidences of the whole ionosphere, response to X-ray events and the effects of gravity waves generated in the tropopause. This group has in the past identified 'signatures' for large earthquakes in addition to the more conventional effects. In the future, the investigators will continue to monitor the ionosphere with their high-frequency Doppler sounders and develop models which will lead to better understanding of these effects.

SUPPORTED BY U.S. Natl. Science Foundation

5.0007, SOIL SURVEY AND MORPHOLOGICAL AND CHEMICAL CHARACTERIZATION OF IDAHO SOILS

M.A. FOSBERG, Univ. of Idaho, Agric. Experiment Station, *Moscow, Idaho* 83843 (0005740; IDA00427)

OBJECTIVE: Support the National Cooperative Soil Survey Program by assisting with soil correlation throughout Idaho and help with the planning of the soil survey program. Supply laboratory characterization data to support individual county soil surveys. Conduct special research investigations on groups of soils which offer problems in mapping and classification.

APPROACH: Work on soil characterization and correlation will be done with the soil surveys and sites selected in conjunction with the Soil Conservation Service, Forest Service, Bureau of Indian Affairs, Bureau of Land Management and Bureau of Reclamation. Soil research investigations dealing with special problems in soil genesis, morphology and classification will also be correlated with the needs of these agencies but will also deal with additional problems to gain a more extensive understanding of the soil development patterns in Idaho. Field studies will characterize the soil in relation to the factors of soil formation including native vegetations, geologic stratigraphic markers, parent materials, archaeological relationships, periglacial climatic effects and modern climatic influences. The laboratory supporting studies will include a wide variety of chemical, mineralogical, particle size distribution and moisture analyses.

PROGRESS: Objectives: Support soil survey program with laboratory, field and research studies and assist in field and correlation reviews. Research: (1) First phase completed on physicochemical and mineral study of volcanic ash and its influence on soil genesis and effects on phosphorus fertilization ash. Influence is very striking both on soil genesis and phosphorus absorption. (2) Study is completed on effects of soil series on tax assessments in the Palouse region of Idaho and Washington. (3) Research on characteristics and influence of loess paleosoils in Palouse region of Idaho and Washington is nearing completion. (4) First year of special project on acceleration of soil surveys with graduate students was successfully completed. (5) Use of remote sensing with LANDSAT images for reconnaissance surveys was started. (6) General soils map for Idaho was compiled and drafted. (7) Characterization laboratory was supported with new technician by Idaho State Soil Conservation Commission. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0008, STUDIES OF IONOSPHERIC SCINTILLATION PROBLEMS

C.H. LIU, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (ATM75-21755)

This grant supports the theoretical study of radio-wave scintillations caused by the ionosphere. The primary advancements to be made are the consideration of multiple scattering, of scattering regions sufficiently thick so that the background electron density cannot be taken as a constant, and of a power-law (rather than Gaussian) size distribution of irregularities. If the ability can be developed to model these effects in adequate agreement with data, then a powerful step towards understanding the processes that cause the irregularities will have been made.

SUPPORTED BY U.S. Natl. Science Foundation

5.0009, INVENTORYING AND MONITORING OF EARTH RESOURCES BY REMOTE SENSING

M.F. BAUMGARDNER, Purdue University, Agric. Experiment Station, *Lafayette, Indiana* 47907 (0008923; IND050020)

OBJECTIVE: Study the relationships between the multispectral radiation characteristics of soils and the physical and chemical properties of soils. Study the relationships between the radiation characteristics of vegetation and the properties of the soils on which the vegetation is growing. Conduct research on the application of remote sensing for determining land use, soil delineations, and vegetation mapping.

APPROACH: Multispectral scanner data obtained from aircraft and spacecraft platforms, aerial multispectral photography, and ground observation data will be used in the preparation of earth resources inventories. Both supervised and non-supervised programs will be used in the computer-implemented analysis of multispectral data. Ground observation data will be used as training sets for computer-implemented analysis and for testing analysis results. These techniques will be used in the preparation of land-use inventories, soil surveys, and vegetation maps. Sequential data (multispectral scanner passes over the same site on different dates) will be used to detect and monitor changes.

PROGRESS: Computer-assisted analysis of multispectral data has been used to identify, monitor, and study land, vegetation and water resources. The most significant accomplishment was the completion of the land-use inventory of 34,000,000 hectares in the U.S. portion of the Great Lakes Drainage Basin. Multispectral scanner data from LANDSAT-1 were analyzed by pattern-recognition techniques to produce a color-coded map of each of the 192 counties in the watershed. Land-use categories identified by color include forests, cultivated lands, urban areas, and water. Thirteen Level 1 and Level 2 land-use categories were identified by spectral analysis and presented in tabular form for each county. Cooperative research between Purdue/LARS and the Soil Conservation Service/USDA were initiated to evaluate computer-assisted analysis of LANDSAT data as an aid in soil survey. Results to date in Chariton County, Missouri, Clinton County, Ind., and Elkhart, Ind., suggest that these techniques can be quite useful to the soil survey program in at least three ways: (1) to provide a spectral map base for planning field operations; (2) to identify soils differences and delineate boundaries which are not easily observable by visual means on black and white panchromatic photographs. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0010, PHENOLOGICAL RESPONSE OF PLANTS TO THE ENVIRONMENT

B.O. BLAIR, Purdue University, Agric. Experiment Station, *Lafayette, Indiana* 47907 (0011500; IND050021)

OBJECTIVE: Continue to study the seasonal variations of the environment as measured by the phenological response of plants to climatic parameters and soil variations using the application of remote sensing techniques where applicable to available data.

APPROACH: Develop a phenological calendar from observations of plant species established which can be used for comparison of post- season plant performance and for projecting the progress of current growing conditions with previous seasons, by relating comparative rates of progress of phenological events to the chemical and physical characteristics of the soil and climatic parameters. Observations of phenological events of various species will be taken by the official weather observer.

PROGRESS: Effort from this program made possible the integrating of phenology data from the Central and the Northeastern states. Phenology maps of the entire region were possible and do show year-to- year variations over the areas; they also show the progression of plant development from north to south. Crop production patterns should reflect such patterns. The satellite studies also demonstrated both Green and Brown Wave development as well as differences from location to location. A comparison of two locations in Indiana, at Lafayette and at Princeton, showed the influence of a July drought on canopy structure and corresponding correlation with drop in field crop yields. The July deficit in rainfall of 1.5 inches below normal following a wet May in June in Gibson and four adjacent counties, resulted in leaf drop and/or chlorophyll reductions which was readily detected, as

compared with Tippecanoe County which had a near normal season. This July drought, although not severe, did result in over 20 and eight bushel yield reductions in corn and soybeans, respectively, in these areas. This data suggests that reflectance from timber canopies as early as July and August may be useful in forecasting crop yields.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0011, AIR-LAUNCHED BALLOON TECHNIQUES FOR TACTICAL COMMUNICATIONS

A. CARTEN, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF247560)

AF function - advanced balloon systems (surveillance, reconnaissance, communications, environmental research support). Deficiency or opportunity - present vehicles have limited altitude and payload capabilities. Objective - to develop an all-weather operational lighter-than-air (LTA) vehicle or platform to put high-altitude sensors and communications relays on station quickly and on short notice over battle theaters. How research contributes - this work involves experimental investigations connected with the design, fabrication and flight test of a prototype air-launched balloon system (ALBS) for tactical communications. This research will help to make it possible for the Air Force eventually to deploy and inflate in mid-air, automatically and quickly, LTA platforms capable of supporting payloads weighing up to 1000 lbs for 24 hours at altitudes of 80,000 ft or better. Such a capability will enhance the effectiveness of Air Force missions whose mode of operation requires the rapid availability of low-cost substitute satellite systems, such as the TRI-TAC multimode transmission system (478T).

The developmental concepts for a large air-launched balloon system were reported in AFCRL-TR-73-0633. An urgent technical problem identified in the report was the need for a cryogenic storage subsystem to vaporize liquid helium and warm the gas quickly to ambient temperatures. Substantial experimental assistance along this line was obtained in FY 75 and in early FY 76 from the National Bureau of Standards, Cryogenics Division, under Project Orders Y75-808 and Y76- 800. A highly successful test followed in November, 1975, at Holloman AFB, when a full-size balloon was inflated from a ground-based cryogenic system and flown, with a payload of several hundred pounds, to the operational altitude required for an LTA relay platform. With this important milestone achieved the next step is the design and fabrication of flight-weight cryogenic hardware and associated ALBS system components for advanced tests involving mid-air launches. Although the ultimate goal is launching from a cargo aircraft, such as a C-130, at 25,000 ft altitude, an intermediate goal will be pursued under ILIR5H01. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0012, INFRARED MOLECULAR SPECTROSCOPY

S.A. CLOUGH, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF255460)

AF function - target detection, weather forecasting. Deficiency - inability to specify the infrared absorption characteristics of infrared molecules limits our ability to carry out calculations of infrared atmospheric transmission and consequently limits design and operation of infrared target detection systems. Research - studies and laboratory measurements of atmospheric molecular absorption. How research contributes - provides data necessary for computer models of atmospheric infrared transmission and emission and of infrared horizon characteristics. This data and the models are necessary for the design and operation of effective infrared target detection systems.

Utilizing the increasing amount of excellent microwave and infrared spectral data in conjunction with new theoretical techniques and computational programs developed through this research, significantly improved atmospheric transmission parameters will be obtained.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory OP L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0013, STORM DIAGNOSIS

R.J. DONALDSON, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF254550)

Air Force function - protection of aerospace systems in severe storms. Deficiency - current methods for identification and warning of storm hazards are unreliable. Objective - develop radar techniques for diagnosis of storms and attendant precipitation and wind fields. How development contributes - provides improved identification and prediction of convective storm hazards and more reliable definition of scattering and attenuation of microwaves in adverse weather.

Measurements of shear anomalies and reflectivity structure provide data for identification of severe convective storms and for study of storm organization and trend as revealed by interaction of fields of motion and precipitation.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory LY L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0014, ULTRAVIOLET RADIATION

L.A. HALL, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF244820)

AF function - environmental impact of high-altitude vehicles. Deficiency - effect of aircraft effluents on solar UV absorption and on ozone. Objective - to determine solar, ultraviolet energy deposition rates and ozone concentrations. How research contributes - energy deposition rates and ozone concentrations will improve models used in computation of environmental impact of Air Force vehicles.

Balloon flights of a solar spectrometer will provide data on the solar spectrum in the range 2000-3000A, as a function of height in the stratosphere. From these data, energy deposition rates and ozone concentrations will be computed.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory LK L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0015, GEODETIC LASER RANGING

R.W. KING, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF255590)

Air Force function - tactical and strategic weapons delivery. Opportunity - improvement in fundamental geodetic and geophysical information. Objective - investigate and document the analytic theory of lunar librations and formulate a model for earth rotation and polar motions. How research contributes - improved geodetic and geophysical information leads to improved missile accuracies. Projected ICBM accuracy improvements cannot be assured without this research.

Models of the earth's orientation in inertial space will be derived and combined with complementary satellite rotation and orbital models to construct a computer program for analyzing lunar laser and high satellite range measurements. Analyses will be performed using extensive available data to determine geodetic and geophysical parameters required by USAF.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory LW L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0016, CEILING MEASURING EQUIPMENT AND TECHNIQUES

E.Y. MOROZ, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF243780)

AF function - navigation and weapons delivery functions of strategic, tactical, air defense, and airlift forces. Deficiency - the Air Force lacks an effective means to record and display cloud height data, and to automatically determine sky cover. Objective - the objective is to develop an automated laser ceilometer and data processor to determine, record and display cloud height data and to provide information for automatically determining sky cover. How development contributes - an automated laser ceilometer will provide for improved safety in airport operations and reduce the manpower requirement for making routine surface weather observations.

Tests will be conducted to evaluate the performance characteristics of a newly developed, prototype, eye-safe, erbium laser ceilometer. Operational requirements for automatically processing, recording, and displaying the ceiling height and sky cover information will be determined. The automated ceilometer will be operationally tested within the program to develop automated surface weather observations.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory LY L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0017, SITE SELECTION FOR ADVANCED ICBM
S.M. NEEDLEMAN, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF247600)

AF function - select suitable sites in SW United States for the deployment of the MX land mobile missile system. Deficiency - lack of adequate terrain data and low-cost reliable siting methods. Research - provide data on large unmapped areas. How research contributes - increased knowledge of the areas considered for the deployment of the system.

The evaluation of photographic imagery and maps covering over 20,000 SNM by special computer search techniques will determine the potential use of selected areas to meet the required terrain criteria of the MX system. In-house research and field studies using electrical resistivity methods were conducted at a local test site for validation of this technique to locate more accurately the subsurface terrain properties of depth to water and bedrock.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory LW L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0018, TRAPPED NATURAL RADIATION
P.L. ROTHWELL, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF241520)

AF function - surveillance, nuclear detection, missile detection. Deficiency - inadequate knowledge of natural particle radiation produced disruptive effects on AF systems. Research - charged particle flux and energy measurements. Objective FY75 - the data obtained from the S3-2 satellite will be used to derive definitive trapped proton flux profiles (0.1-100MeV). Abnormal dynamic proton injections into the trapping regions during severe magnetic substorms will also be examined. How research contributes - this work contributes to the study of energetic particle fluxes including particle type and spectral parameters determined throughout the magnetosphere. The static intensities are determined as a function of spatial location and formulated in model form. The dynamic, changing intensities are related to solar and geomagnetic substorm activity in order to formulate real-time predictive capability of sufficient accuracy to provide design knowledge for systems which must operate up to 10 years and provide reliable discrimination between operationally required information and spurious signals. Trapped particle flux variations are related to interference experienced by detection and surveillance systems as well as the lifetimes of these systems within the environment.

During this period data obtained from the 72-1 and OV5-6 satellites will be used to generate static and time-dependent models of the earth's proton radiation belt. Proton flux contours will be generated for altitudes of interest to Air Force operational satellites. Data handling will be developed for the S3-2 satellite data.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory PH L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0019, HIGH-ALTITUDE SYSTEM DEVELOPMENT
J.F. WYER, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF243950)

AF function - advanced high-altitude tethered balloon system for surveillance, monitoring, environmental research, space vehicle test. Deficiency - current tethered-balloon technology and equipment limits the use of this type of vehicle to altitudes of less than 10 km. Objective - develop a tethered balloon system capable of flying at an altitude of 20 km. How research contributes - development and flight of a balloon at 20 km will prove the feasibility of operating tethered balloons under these conditions on an operational basis.

The design of a 20 km system, including balloon, cable, winch and other equipment, will be undertaken. Computer simulations of various combinations will be undertaken in order to examine all parameters associated with the problems of attaining higher altitudes. A study of meteorological profiles in the area of the test site is required - winds, for example, have a significant effect on the sizing of equipment. High surface temperatures will exist in the most opportune months, windwise, necessitating provisions for extra cooling of the winch during long periods of reeling. A low-altitude flight test will be made to check the adequacy of winch cooling and to evaluate a prototype of the best candidate Kevlar cable. Suitable balloon and cable specifications will be established to enable their purchase in the following year.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory LC L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0020, ANALYSIS OF LASER RANGING AND VLBI OBSERVATIONS FOR GEODETIC PURPOSES
I.I. SHAPIRO, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DF243260; F19628-75-C-0058)

AF function - weapons delivery. Deficiency - launch site and target position uncertainties degrade accuracy of weapons delivery. Objective - improve models for earth rotation. How research contributes - evaluates accuracy of lunar and satellite laser ranging and VLBI observations as means of determining earth-rotation variations and site positions.

Contractor will perform simulations of lunar and satellite laser ranging observations to determine earth-rotation and station location parameters, and will develop improved models for earth rotation.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory LW L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0021, A GEOLOGICAL AND GEOPHYSICAL STUDY OF THE EASTERN MEDITERRANEAN
D.A. ROSS, Woods Hole Oceanographic Inst., *Woods Hole, Massachusetts* 02543 (OIP75-02516)

This research is directed toward two main objectives. The first is a study of the marine sedimentary regime of the Nile Delta and Cone. It will involve (a) investigating in detail the composition and mode of transport of the sediment supplied from the Nile into the eastern Mediterranean, (b) evaluting changes in delta morphology (using satellite pictures and old maps), (c) relating the stratigraphy of the Nile Cone sediments to the sediments lying outside the Nile's influence and (d) determining the concentration and composition of the suspended matter in the water column.

The second major objective will be to ascertain the shallow and deep structural framework of the Nile Cone and eastern Mediterranean. Specific problems to be addressed will include (a) the origin of a hill and valley structure at the edge of the Nile Cone, (b) establishing when the recent deformation in the area developed and how it has affected the Nile Cone and Herodotus Abyssal Plain, (c) ancient tectonic trends, (d) an estimate of the size of the delta and cone, (e) the nature and extent of seismic reflector M, and (f) an evaluation of the proposed past connection between the Mediterranean and the Red Sea. The answers to these problems will shed considerable light on the evolution of the eastern Mediterranean and the development of the Nile Delta and Cone.

SUPPORTED BY U.S. Natl. Science Foundation

5.0022, WEAPON CONCEALMENT AND SIGNATURE CONTROL IN COLD REGIONS
H. OBRIEN, U.S. Army, Cold Reg. Res. & Engin. Lab., *Hanover, New Hampshire* 03755 (DA0S8147)

To study the mechanism of ice nucleation and fog creation using various nucleating agents; develop practical techniques for dispersing fog, thereby increasing visibility, and improve characteristics of military communications systems, increase the amount of information on spectral reflectance properties of snow under various environmental conditions, and study the propagation and degradation effects of laser beams in ice.

The effectiveness of compressed air as a substitute for liquid propane for dispersing supercooled fog will be evaluated. Laboratory investigations will be conducted under conditions of varying temperature and humidity to develop efficient seeding techniques. Spectral reflectance measurements (0.2 micron to 2.5 micron wavelengths) of snow will be conducted, including varied snow conditions and angles of incidence and reflection, and goniometric studies of snow reflectance using lasers will be initiated. Ice specimens will be subjected to variable power densities from both c-w CO2 and pulsed ruby lasers to study degradation threshold in ice.

ADDENDA: Supporting Agency Address is: OCE Cold Regions Research & Engineering Lab, Hanover, NH 03755

SUPPORTED BY U.S. Dept. of Defense - Army

5.0023, MARINE FOG INVESTIGATION

R.J. PILIE, Calspan Corporation, *Buffalo, New York* 14221 (DN330033; N00019-75-C-0508)

The objective of this investigation is to improve the understanding of the phenomenon of fog at sea. This understanding is necessary to improve the ability to forecast the occurrence of fog at sea and to develop techniques to control fog, that is, to dissipate or create it.

An at-sea measurement program is being conducted during the life cycle of fogs. Atmospheric data to be acquired fall into three categories: fog microphysics, micrometeorological data, and aerosol characterization. Collectively, these data will provide detailed life histories of important fog properties and air mass characteristics. Oceanographic measurements will be made concurrently to gain an understanding of air-sea interaction influences. To date all measurements have been made off the coast of California. Under this contract measurements will be made in the North Atlantic.

ADDENDA: Supporting Agency Address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0024, INTERNAL WAVES INITIATED BY TEMPERATURE INVERSIONS

J.H. CLARKE, Brown University, Graduate School, *Providence, Rhode Island* 02912 (DN223201; N00014-76-C-0154)

Clear air turbulence in the atmosphere and similar turbulence in the ocean interior, despite their importance for naval missions, have thus far defied understanding of their initiation, development and decay. When fluids possess density stratification and velocity shear, there exist conditions under which internal waves form unstably, break and create turbulent regions which are not homogeneous with the ambient environment. Since initiation of such waves is not understood, intensive analysis is necessary to discover mechanisms which account for their presence.

Clear air turbulence has been observed to occur often in the presence of a temperature inversion at the top of which a shear layer exists. In this investigation such a layer is treated as a heat engine and will be analyzed to discover the condition under which clear air turbulence will develop. The results will be integrated with an experimental simulation of clear air turbulence in the Brown University low-speed tunnel and should lead to an explanation of the formulation of this type of clear air turbulence.

ADDENDA: Supporting Agency Address is: Office of Naval Research 438, Arlington, VA. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0025, ATMOSPHERIC TURBULENCE EFFECTS ON THE TEMPORAL-SPECTRAL DENSITIES OF OPTICAL SIGNALS 12867-GS

J. SMITH, Univ. of Texas, School of Engineering, *El Paso, Texas* 79999 (DA0H5579; DAHC04-75-G-0102)

To develop models for optical crosswind systems to describe the temporal spectral densities of remote scenes viewed through a turbulent atmosphere. Relevance - atmospheric turbulence effects over different ranges is important in several laser propagation systems being developed or currently used in the Army. ASL is particularly interested in turbulence effects in the laser remote sensing crosswind measurement system under development for use in the main battle tank. 'The program could be relevant and important for laser weapon systems or systems employing laser guidance' (MICOM). 'The resolution of the effects of saturation is fundamental to the application of this scheme (optical measurement of wind) under many turbulence-path-length conditions.' (BRL).

Simulataneous measurements yielding the spectral densities obtaining from intensity and angle of arrival fluctuations of remote scenes and of beams from coherent sources will be made over 0.5 km and 2.0 km horizontal paths during periods of strong and weak turbulence and a variety of wind conditions. The spectral characteristics will be compared with in-situ measurements of related meteorological parameters to check the validity of the model predictions. Upon establishment of the expected spectral characteristics, spatial and temporal filters will be used to obtain wind profiles along the path.

ADDENDA: Supporting Agency Address is: DARCOM Army Research Office, Box 12211, Research Triangle Pk., NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

5.0026, PROGRAM FOR ANTARCTIC MAPPING OPERATIONS

R.H. LYDDAN, U.S. Dept. of the Interior, Geological Survey, *Herndon, Virginia* 22092 (DPP76-00197 A01)

This renewal continues support of the U.S. mapping operations in Antarctica. The geodetic, cartographic and support activities of the U.S. Geological Survey include field control for mapping and for science projects. Support for international responsibilities of the U.S. under the Scientific Committee on Antarctic Research will be provided by exchange of cartographic materials with other countries, and the preparation and maintenance of photographic and map files and indexes. The computation and adjustment of previously established control and the printing of aerial photography for mapping and for reference purposes will also be carried out. Specific field activities during the 1975-76 field season include accurate location of research sites on the Ross Ice Shelf by means of satellite observation.

Two USGS cartographic engineers will carry out field work in Antarctica during the 1976-77 field season. Two USGS scientists will carry out satellite observations through 1977 at South Pole Station.

SUPPORTED BY U.S. Natl. Science Foundation

5.0027, NAVY ENVIRONMENT - TEMPERATURE AND SALINITY PROFILES IN SALT WATER BELOW THE AIR-SEA INTERFACE

K.B. KATSAROS, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DN223057; N00014-75-C-0502)

The flux of temperature and salinity at the very surface of the sea determines the stability of the underlying water as well as the apparent infrared temperature of the surface when scanned by remote-sensing equipment. Thus, these fluxes affect ASW sonar in this region as well as infrared surface phenomena. The objective of this work is to define these fluxes directly under a variety of conditions.

The heat, water vapor and salinity fluxes are being examined in three phases: theoretical, laboratory and field. Earlier theory is being tested in the laboratory using micro-sensing equipment approaching the water surface from below to avoid meniscus (surface tension) effects.

ADDENDA: Supporting Agency Address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, COMPUTER-AIDED DESIGN METHODOLOGY
N.M. AUME, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF319130)

To furnish a human engineering computer-aided design (HECAD) in combination with computerized biomechanical man-model (Combiman) to provide an interactive computer graphic design program for use in crew station design.

Initial data banks are developed with information on the workspace panel configuration, control/display components and task sequences to be accomplished for specific system/mission applications. The anthropometric data bank in Combiman will provide data on size and biomechanical capabilities of the operator. By using the stored data bank information, workspace layout and panel configuration can be designed and evaluated by interactive computer graphic techniques. Specific criteria for task/mission performance effectiveness are established for purposes of panel/workspace evaluation. This work was formerly reported under work unit 7184-08-07, Biomechanical Criteria of the Design of AF Systems.

ADDENDA: Supporting Agency Address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0002, AIR COMBAT PILOT PERFORMANCE MODELS
H.S. BOAL, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF319030)

To conduct analysis on current and planned air-to-air combat simulations in the Dynamic Environment Simulator (DES). To model the human in the final tracking phase of air-to-air combat. To regress human operator model parameters against seat back angles and gz. To develop human operator models for the unconventional control modes available in AFTIO type experimental aircraft simulated on the DES. To analyze AFTI- type air-to-air engagements.

Classical statistical analysis and spectral analysis techniques will be used in addition to human operator modeling techniques.

ADDENDA: Supporting Agency Address is: 6570 Aerospace Medical Rsch Lab EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0003, SELF-ORGANIZING CONTROL-RPV AUGMENTATION
M.W. CANNON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF316990)

The goals of this study are: 1) to determine the effectiveness and appropriate utilization of a self-organizing controller (SOC) in the RPV mission, 2) to establish minimum data rate transfer to the operator with and without SOC augmentation, 3) to investigate more efficient logic configurations and alternative methods of parameter search algorithms to improve SOC.

The study is divided into six phases of RPV simulation. In Phase I, man's tracking ability will be evaluated with and without SOC in the absence of video information. Phase II, various controllers, i.e., bang- bang, proportional, adaptive (SOC), will be compared during the terminal attack (tracking) in the absence of video information. Phase III will repeat Phase II experiments with maximum video information available to the controller. In Phase IV, video information will be degraded and frame rate reduced, the operator's performance with the various controller will be measured. Phase V will examine operator's performance with and without augmentation controls during ECM jamming. The final phase, Phase VI, will combine reduced video transmission, reduced frame rate, and jamming in order to quantify the utility of SOC in terms of the RPV operator's performance when the attack phase is hampered by reduced and degraded video information.

ADDENDA: Supporting Agency Address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0004, BIOACOUSTIC ENVIRONMENTS OF USAF AEROSPACE SYSTEMS
J.N. COLE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF313030)

Aircraft, auxiliary equipment, missiles and other Air Force systems oftentimes produce acoustic environments which are potentially hazardous, interfere with communication and performance or are annoying. Flight crews, passengers, maintenance personnel and Air Force and civilian communities can be affected. Personnel protection, communication equipment, limiting exposure times, community response and siting of noisy facilities are some of the factors which must be considered. The objective of this research is to provide the physical data describing these environments in ways required to evaluate and solve these bioacoustic problems.

Measure, analyze and simulate AF noise environments using precision analog and digital instrumentation. Apply established theoretical and empirical procedures and information on source characteristics, atmospheric sound propagation, structural noise reduction, etc., to extrapolate and predict sound pressure spectra, perceived noise levels, speech interference levels and other such measures of acoustic environments.

ADDENDA: Supporting Agency Address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0005, PHYSIOLOGICAL DETERMINANTS OF HUMAN PERFORMANCE
A.T. KISSEN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF319020)

To quantify the changes in pilot control capabilities associated with impairment of oxygen delivery to the brain in thermal, acceleration, and combined stress environments. This work unit supports development of the international fighter, high-acceleration cockpit, and control-configured vehicle programs.

A coordinated series of human experiments in thermal, altitude, acceleration, thermal-acceleration, altitude-acceleration, and thermal altitude-acceleration environments are to be accomplished. These will document changes in critical pilot control characteristics during the stresses and isolate critical physiological subsystems involved with oxygen delivery to the central nervous system via noninvasive techniques. This data will be combined with that from a concurrent series of invasive animal experiments and a dynamic model describing man's control characteristics as influenced by the changes in cardiopulmonary function in complex stress environments developed.

ADDENDA: Supporting Agency Address is: 6570 Aerospace Medical Rsch Lab EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0006, MEASUREMENT AND ANALYSIS OF AIRCRAFT NOISE ENVIRONMENTS FOR DEVELOPING NEW AF PROCEDURES TO FORECAST NOISE EXPOSURE AROUND AIR BASES
J.D. SPEAKMAN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF316600)

Measure and analyze the noise produced by military aircraft operations (takeoff, landing, flyover, runup) as specifically required to calculate noise exposure for use in estimating community response and planning land use around air bases. At the present time, files contain only estimated data on many aircraft systems. This effort will improve accuracy and reliability of community-aircraft predicted noise exposure.

This effort will be accomplished using previously developed data acquisition systems, General Radio Real-Time Spectral Analyzer, CDC 1700 interface, and various computer software programs. Although these measurements are required on virtually all aircraft types in inventory, most will be accomplished at WPAFB due to restrictive requirements on weather conditions, tracking, ground cover, local traffic, background noise, etc.

ADDENDA: Supporting Agency Address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0007, EFFECTS OF COMBINED STRESSES ON NAVAL AIRCREW PERFORMANCE

M. PASSAGLIA, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN233054)

To study the effects of combined stresses on aircrew performance and fatigue under dynamic conditions simulating the operational environments of fighter/attack, patrol/support, and helicopter aircraft, in order to improve crew proficiency and safety of flight operations, to quantify the extent to which each stress contributes to total fatigue, and to define the actual mechanisms by which these stresses affect the aircrews. Requirements for this work are included in the FY 1974 Naval Aviation Biomedicine/Human Effectiveness Report.

Physiological and performance data will be collected from trained personnel performing simulated aircrew tasks while being exposed to various combinations of stresses similar in intensity and duration to those encountered during flight in military aircraft. These stresses include accelerations, vibration (buffet), noise, ambient temperature and pressure, ambient light levels, and the restrictions to mobility and vision imposed by wearing personal protective equipment and using restraint devices. Through appropriate experimental designs, the separate effects of each stress, as well as their combined effect (interactions) will be studied. The NADC Dynamic Flight Simulator will be used to provide operational simulations of present and future high- performance fighter/attack, V/STOL, helicopter and patrol/support aircraft.

ADDENDA: Supporting Agency Address is: Commanding Officer, National Naval Medical Center, Bethesda, Maryland 20014

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0008, MULTIPURPOSE SUCTION PUMP FOR AEROMEDICAL AIRLIFT

M.J. CHANDLER, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF317140)

Provide a multipurpose portable suction apparatus which meets the therapeutic, operational, and logistic requirements for use in aeromedical airlift. The suction pump presently available for use in aeromedical airlift has limited vacuum range and adjustments and cannot be used for closed cavity intermittent suctioning, fails to comply with radiated and conducted emission limits as specified in MIL-STD 461A, and is no longer manufactured commercially. A waiver was requested from AFSC/ASD to permit operational use of the two GOMCO pumps. On 17 October 1972, AFSC/ASD authorized a two-year waiver of the radiated and conducted emission requirments of MIL-STD 461A. The waiver was given with the understanding that the USAFSAM would meet all medical and military requirements. The use of suction pumps in aeromedical airlift is an urgent requirement that can be met by the multipurpose pump proposed in this in-house development effort.

Utilize valuable preliminary information gained from the testing of suction pumps including the GOMCO, Carmody, and PESCO. Continue to survey the commercial market for a device which meets the required functional characteristics, durability, and cost range acceptable for suction devices for aeromedical airlift. Procure complete units and/or components for development test and evaluation and make necessary modifications. Send the suction device to the major commands for operational test and evaluation, and prepare a data package.

ADDENDA: Supporting Agency Address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0009, CHARACTERIZATION OF HYDROCARBON EMISSIONS FROM AIR FORCE TURBINE ENGINES

J.P. CONKLE, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF319230)

The effort will provide baseline data for assessing the biomedical impact of Air Force aircraft operations, prior to the advent of regulatory restrictions. The information is required not only for assessing environmental impact but also for evaluating combustor design criteria, smoke suppression additives and engine operational cycles. The work is closely coupled and coordinated with ongoing turbine engine emissions measurement at the AFWL and AFAPL.

Chemical characterization of the organic compounds present in turbine engine exhaust will be accomplished for both gaseous and particulate species. Samples will be obtained from a variety of sources including AF and Navy operational engine test stands and the AFAPL single combustor test rig. Analysis will be performed by a coupled gas chromatograph-mass spectrometer data system. Results will be screened by AMRL/TH for toxic hazard assessment.

ADDENDA: Supporting Agency Address is: USAF School of Aerospace Medicine Vn, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0010, EFFECTS OF ENVIRONMENTAL STRESSES ON CARDIOVASCULAR FUNCTION

H.H. ERICKSON, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF316490)

Air Force personnel may encounter a wide variety of environmental extremes in the performance of their role as an integral part of a tactical or strategic weapon system and are expected to function effectively under all conditions. Data are not available to evaluate man's response and tolerance to all of the possible single and multiple stresses that he may encounter. This effort is designed to determine man's cardiovascular response to such combined stresses as hypoxia, hypercapnia, increased workloads, fatigue, acceleration, and the interaction of these stresses, particularly as they impact on acceleration tolerance. This will permit a better understanding of the mechanisms responsible for man's performance and response during stress and will enable the Air Force to develop better protective countermeasures. This effort is responsive to NASA-Ames ESP 921E-0000- 010, and in-house work unit 7930-03-25.

Experimental animals, including subhuman primates, will be used as models to evaluate the effects of these stressors on the cardiovascular system. The animals will be chronically instrumented with blood pressure and flow transducers in order to study cardiac function and the coronary and cerebral circulation. New techniques of data acquisition and on-line computer analysis will be used to quantitate the effects of stress and combined stress on the heart and cardiovascular system. Mathematical modeling and systems analysis will be used to predict the response to stress which man encounters in advanced aircraft systems.

ADDENDA: Supporting Agency Address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0011, EFFECTS OF HIGH INTENSITY-MANEUVERING, ACCELERATION AND REPETITIVE G ON PILOT PHYSIOLOGIC PERFORMANCE IN FIGHTER-ATTACK AIRCRAFT

K.K. GILLINGHAM, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF318610)

Flight operations with high-performance tactical aircraft such as the F-15 and F-16 require continuous optimal crew performance during aerial combat maneuvering (ACM). The objective is to investigate the effects of gravitoinertial forces on pilot physiologic performance during maneuvering acceleration to define human physiologic tolerance and safe exposure limits to ACM, and to obtain data which can be used to evolve methods to improve the pilot's G tolerance to match the structural capability of the new generation fighter aircraft.

Extensive evaluation of the cardiac and pulmonary systems in man and animals will provide data for defining physiologic responses to aerial combat maneuvering acceleration. Indirect instrumentation of human volunteers and direct instrumentation of swine, dogs, and subhuman primates will be used during simulated ACM G stress on the USAFSAM human centrifuge. Blood oxygen saturation, cardiac output, cardiac contractility, eye-level blood pressure and flow, and physical and mental fatigue indicators will be parameters of interest. Where possible, linear systems analysis techniques will be used to reduce the data to convenient predictive functions.

ADDENDA: Supporting Agency Address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0012, COMPUTER TECHNIQUES FOR ESTABLISHING TOLERANCE TO AIR FORCE STRESSES
H.M. HUGHES, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF317480)

Air Force studies to determine the tolerance levels of aircrew and support personnel to various operational stresses involve the acquisition, storage, and manipulation of interrelated biomedical, engineering, and environmental data. Techniques for utilizing computers, both analog and digital, for achieving these functions exist only partially, often in unverified form. This effort will identify valid computer techniques when they exist, adapt such techniques to the Air Force application at hand, and develop new techniques as required. The end result will be to avoid erroneous conclusions from anomalies due to improper acquisition, storage, and manipulation of study data, while reducing the manpower and time required to accomplish the study.

Techniques to be developed will be identified in two ways. First, during the planning stage of each stress tolerance study we will identify the data manipulation needs and provide for them by utilizing existing techniques if possible, adapting others, and developing specialized techniques when adequate ones do not exist. Second, we will energetically maintain awareness of developments in both computer hardware and software that might be used or adapted to make biomedical studies in the biotechnology exploratory development program more efficient.

ADDENDA: Supporting Agency Address is: USAF School of Aerospace Medicine BR, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0013, OPTIMIZATION OF AIRCREW UTILIZATION BY COMPUTER SIMULATION OF OPERATIONS
H.M. HUGHES, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF317490)

The effect of aircrew management policies on operations is complex due to the many factors involved and the interaction of the various factors. Studies of the individual effects of single factors are not adequate. Optimum values of aircrew manning and handling can be achieved through actual operations but at a cost in time and noneffectiveness. Furthermore, this approach cannot solve the problem of anticipated conditions not yet experienced. This effort will provide supportable estimates of optimum aircrew manning under anticipated airlift operational conditions.

A computer simulation program, developed several years ago at USAFSAM, which focusses on the aircrew aspects of airlift operations, will be modified to reflect current operational concepts and current aircraft capabilities. With this tool, operational and aircrew data for six months can be produced in a fraction of an hour. We will explore the impact of various manning postures on anticipated real or contingent airlift operational requirements via the computer simulation. We will, as required, also explore the feasibility of adapting this tool to the aircrew aspect of operations other than airlift.

ADDENDA: Supporting Agency Address is: USAF School of Aerospace Medicine BR, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0014, AVIATOR'S BREATHING OXYGEN CONTAMINANT DETECTOR
K.G. IKELS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF315240)

Headquarters, Air Training Command, issued Required Operational Capability No. ATC 2-72 in June, 1972, for a portable oxygen contaminant analyzer. This ROC is for an immediate analysis capability for oxygen samples taken from aircraft following an inflight physiological incident where aviator's breathing oxygen is implicated. The ATC ROC was validated by HQ USAF on PMD No. R-Q3-013-(1), dated 21 July 1972. The objective of this effort is to develop a portable contaminant detector for base level personnel to perform oxygen analysis in accordance with use limits specified in T.O. 42B6-1-1.

Feasibility of a miniaturized portable infrared analyzer for field detection of use limit contaminants in oxygen was demonstrated in a DT E program conducted in FY 74. The instrument transitioned to engineering development in late FY 74 is now managed by ASD/AEL under Endeavor AO 258. In FY 75 and FY 76 design modifications and systems procurement were initiated. Operational T E will be conducted in FY 77 and initial inventory deployment in FY 77.

ADDENDA: Supporting Agency Address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0015, RADIOFREQUENCY RADIATION EFFECTS ON BIOCHEMICAL SYSTEMS IN THE CENTRAL NERVOUS SYSTEM
J.H. MERRITT, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF318800)

The Department of Defense Triservice Electromagnetic Radiation (EMR) Bioeffects Research Program describes the central nervous system (CNS) as the 'singularly most important area where there is evidence that EMR interacts with biological systems.' The objective of this effort is to quantitate the radiofrequency (RF) EMR effects on biochemical events subserving nerve transmission in the CNS. The information obtained will be applied to establish more appropriate safety standards for personnel working in close proximity to AF RF emitters.

The effects of RF radiation on the CNS, specifically on a specialized function of the neuron, namely synaptic transmission will be studied. It is probably true to say that every cell in the brain is connected, directly or indirectly, to every other cell by chemical switching systems (synaptic transmission). This effort will attempt to quantify changes produced by RF energy in these chemical systems, determine thresholds for frequency and power density, and interpret these changes in terms of the expected effect on man in AF operational environments.

ADDENDA: Supporting Agency Address is: USAF School of Aerospace Medicine RA, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0016, IMPACT OF RF BIOEFFECTS ON AF OPERATIONS
J.C. MITCHELL, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF318810)

Maintain a radiofrequency radiation (RFR) bioeffects technology base to support environmental impact positions and to establish operational RFR safety criteria for current and future Air Force systems. Evaluate specific biological consequences of man's exposure to unique pulsed RF fields from phased array emitters, and compare with current findings as reported in pulsed versus continuous wave radar exposures.

Radiofrequency radiation effects data will be compiled, analyzed, and applied to establish systems specific exposure criteria in accordance with AF mission requirements and operational situations. Additional research data will be obtained through a tri-service multi- agency contract with the Franklin Institute to provide periodic reports, 'Digest of Biological Effects of Electromagnetic Radiation.'

ADDENDA: Supporting Agency Address is: USAF School of Aerospace Medicine RA, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0017, PSYCHOLOGICAL AND PSYCHOMETRIC CHARACTERISTICS OF USAF AIRCREWS
J.K. PHILLIPS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF319540)

To determine current normative behavioral patterns and performance on psychometric instruments. To explore the relationship between these parameters and other physiological and behavioral data, for aircrew members. The purpose of the effort is to define empirically the unique psychological aspects of the population of flying personnel and how various specially selected groups differ from other aircrews on routine status. This is expected to refine both the initial selection and continued maintenance of aircrews at a high proficiency level, both for routine operations and special projects.

Behavioral, psychometric and/or interview data will be collected from flying personnel in all rated categories, some of which personnel will be SAM patients, some nonpatients in operational flying jobs, and some who, by virtue of unique experiences as aviators, form distinct subgroups within the flying population. These data will be combined with demographic and laboratory physiologic data when appropriate, and submitted to statistical analysis to determine the type, strength, and uniqueness of reliable relationships among the data. These relationships will be clarified and refined in the course of continuing studies. The program of research will eventuate in a reliable, valid set of relationships and empirical norms useful in conceptualizing and solving the problems of active aviators. New measures and norms more appropriate than those currently available for evaluation, description, and training of aircrews are expected to result from this work.

ADDENDA: Supporting Agency Address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0018, LITERATURE REVIEW OF DOCUMENTS PERTAINING TO EPIDEMIOLOGIC ASPECTS OF AIR FORCE OPERATIONS

J.P. SCHMIDT, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF318230)

Maintain capability for timely response to Air Force needs for R D efforts in fields of microbiology, immunology, toxicology, drug abuse detection, and laboratory methodology.

Review available scientific literature for information pertinent to Air Force medical operations, disease surveillance, epidemiologic intelligence and laboratory methodology. Evaluate findings from other R D projects for spinoffs having potential application to aerospace medicine.

ADDENDA: Supporting Agency Address is: USAF School of Aerospace Medicine EP, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0019, EVALUATION OF NEW CONCEPTS FOR TACTICAL AIRCREW HELMETS

W.J. SEARS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320640)

Tactical Air Command has an immediate requirement for improved headgear for aircrews of new generation fighter aircraft, and special operational studies scheduled in FY 77 will present a unique opportunity for field evaluation of new helmet concepts. The USAFSAM has favorably evaluated a proposed contract effort to fabricate and evaluate a new aircrew helmet. The principal objective of this inhouse program is to apply unique USAF facilities and expertise to complement the contractual effort, resulting in a composite program of unprecedented comprehensiveness and detail. The intent of the effort is to provide fundamental design guidance to ASD for use in improved development and procurement specifications, and additionally to insure that new concepts are made available for field trial in an expeditious manner.

Upon availability of helmets USAFSAM will undertake an evaluation program including compatibility with current and prototype aircrew oxygen equipment, effectiveness at high altitude and under rapid decompression, stability under high and sustained acceleration, subjective comfort, thermal impact, fixed visual fields, visual fields during acceleration, maintainability, cockpit compatibility, and other considerations. Additionally, USAFSAM and AMRL specialists will monitor contractor-performed evaluation of impact, retention, and acoustics properties. Resulting data will be incorporated into design guidance for more general application in ASD development efforts. This effort supports TAC ROC 16-72A, Aircrew Protective Headgear, and directly relates to optimal employment of the F-16, F-15, and F-5 aircraft. It will be closely coordinated with the Tactical Air Warfare Center, the 412A Life Support SPO, the ASD Aircrew Equipment Support Division and other relevant organizations.

ADDENDA: Supporting Agency Address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0020, CHEMICAL DEFENSE PERSONAL EQUIPMENT FOR AIRCREW

R.D. SINCLAIR, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320270)

The purpose of this effort is to establish an in-house test and evaluation capability that is designed specifically to provide direct support to the 412A Life Support SPO, Chemical Defense (CD) Division, in its program to develop CD personal equipment for crewmembers of high-and low-performance aircraft. The work unit is tailored to address all biomedical and environmental test requirements that are anticipated to arise during various stages of new equipment development and/or modification of existing equipment by the SPO. Laboratory experiments will also be conducted to explore the physical characteristics of activated charcoal. The justification for establishing this supportive effort is based upon a recently approved Memorandum of Agreement between AMD and the Chemical Defense Program Office (30 Jan 76). The MOA states that T E support will be subject to reimbursement, the latter defined as a specific cost schedule in an AMD/RDU letter to ASD/SMLS dated 9 Feb 76. Further impetus is given to the establishment of this effort by the draft TAF (ROC) 33075 dated 31 Dec 76 (CW Mask for Tactical Fighter Aircrew) and current interest expressed by the U. S. Army (Edgewood Arsenal) and the U. S. Navy (Naval Explosive Ordinance Disposal Facility) for CD equipment leak testing (ASD/SMD letter to AEL/MMNC dated 4 Feb 76).

The aircrew special requirements function of the environmental sciences division will serve as the OPR for the CD program to be accomplished within the USAFSAM. The OPR will plan programs and coordinate all T E activities to be accomplished by various organizations within the laboratory. Specific areas of test and environmental simulation will consist of altitude exposure, including pressure breathing levels and rapid decompression, respiratory impedance measurements, thermal profiles, air combat maneuvering (ACM) G exposures, gas leakage characteristics, equipment related performance decrement, and integration with other life support equipment and cockpit configurations. Standard operational profiles for the environmental conditions will be simulated and the sodium chloride cloud technique will be utilized for leak testing purposes (actual CW agents, simulants or antidotes will not be used for any tests). The OPR will also provide biomedical consultation and review technical req (Text Truncated - Exceeds Capacity)

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0021, DEVELOPMENT OF ENGINEERING ANALOGUES FOR HUMAN PERFORMANCE

W.F. STORM, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF319430)

The application of human operator technology (HOT) for the analysis of man's performance in operational systems shows promise as a powerful technique for predicting performance change and/or deterioration. HOT analyses provide human performance data in a format that is of immediate and direct use to a systems design engineer. HOT is sensitive to the man/machine interface and, through development of transfer functions, reveals when the human operator changes his operating characteristics. Development of tasks at SAM which permit HOT analyses of performance data offers a distinctly new means of studying the effects of environmental variables on human skills. Research in this work unit supports Project 7222 and the RPV program plan.

A collaborative program with the 6570 AMRL/EM is being conducted to develop at USAFSAM the hardware and analytic techniques appropriate to the 'human operator' model created by EM. Initial efforts relate human operator data to more conventional psychomotor data. Fundamental HOT task consoles have been acquired and programmed. They are designed for simplicity and careful input/output control. Future development will involve application of HOT analyses to human performance in motion-base, LINK GAT-1 flight trainers.

ADDENDA: Supporting Agency Address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, THEORY OF CONTROL AND COMMUNICATION SYSTEMS APPLICABLE TO THE DESIGN OF AEROSPACE SYSTEMS

A.V. BALAKRISHNAN, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (DF036100; AF-AFOSR-2492-73)

Air Force function - the performance of complex modern Air Force systems is determined as much by the manner in which they are controlled as by their physical characteristics. Deficiency - from a practical viewpoint the least understood aspect of the control system design process is the formulation of a mathematical model which relates system behavior to the forces driving it, and inadequacies here limit the performance which can be achieved by the controller. Objective - the objectives of this research are to develop new identification and control methods for systems not described in state-space form and for distributed parameter systems, and to further explore the epsilon technique for optimal control computation. How work contributes -success in these objectives would contribute to the performance of Air Force systems at minimal expense.

The feasibility of the epsilon technique will be investigated for application to specific classes of nonlinear optimal control problems. System identification and control methods will be developed for cases where the system dynamics are not given in state-space form. In the area of identification and stochastic control of distributed parameter systems the use of Gauss measure on a Hilbert space will be extended to nonlinear systems. Finally, the mode control problem, to eliminate destructive flexure mode energy excited by unpredictable disturbances, will be addressed, using a distributed parameter model approach.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0002, RELIABLE SOFTWARE PROGRAM SYSTEMS

T.H. BREDT, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DF041170; F44620-75-C-0082)

The production of computer software in the Air Force is big business. It is estimated that the Air Force is spending over $2 billion per year on software. We are still unable to insure that this software is reliable. These software reliability problems could cause the Air Force to lose critical command post or satellite capabilities in a strategic crisis situation. This research effort proposes to develop reliable program systems such as operating systems for digital computers. The objective is to develop general design methods that can be applied to a large class of systems and result in systems that are correct, i.e., free from logical errors. A system driver will be designed to simulate a multi-user environment. This will be used to evaluate system performance and check on the verification of system correctness.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0003, ALGEBRAIC FOUNDATIONS OF STABILITY THEORY - A COMPUTERIZED LINEAR ALGEBRA BIBLIOGRAPHY

M. MARCUS, Univ. of California, School of Letters & Science, *Santa Barbara, California* 93106 (DF033060; AF-AFOSR-2164-72)

The design of effective aerospace vehicles require the solution of many basic problems in the pertinent engineering sciences. Of particular interest are problems in solid mechanics, aerodynamics and structural dynamics. Some important problems in these areas (i.e., dynamic stability, buckling, etc.) require knowledge of the distribution of the eigenvalues of matrices which arise in the formulation of such problems. Other aspects of interest to these problems are: bounds for eigenvalues of matrices, eigenvalue inequalities, and eigenvalues of matrix sums, products and minors. This research effort will examine some of these topics with the objective of establishing a firm base for the solution of the problems discussed above. Particular areas of research to be examined are: the reduction theory of matrix pencils and its relevancy to dynamic systems - location theorem for eigenvalues of various combinations and classes of matrices - the structure of the numerical range and extension of the Bernau-Wigner-Kaplansky-Herstein results on normality and commutativity - quadratic forms on tensor spaces, the structure of linear transformation on a given set of matrices with prescribed invariants. In addition, efforts will be spent in the construction of an usable linear algebra bibliography. During this grant period emphasis will be placed in the examination and classification of papers in the computational numerical methods category.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0004, STUDIES IN OPTIMAL CONTROL, ESTIMATION, AND LINEAR SYSTEMS THEORY

C.L. SMITH, Louisiana State Univ. Systems, School of Arts & Sciences, *Baton Rouge, Louisiana* 70803 (DF037550; AF-AFOSR-2580-74)

Sophisticated control, navigation, reconnaissance, surveillance, and weapon systems presently in the Air Force inventory depend to a major extent upon modern control theory. The challenge of sustaining these systems in the technological forefront intensifies as the defense budget declines. Most of the innovations available through modern control theory which are necessary for system synthesis require extensive and costly engineering development and prohibitively expensive hardware for implementation. In some cases minor compromise with respect to optimality could foster a vast reduction in complexity, and in fact could effect the realization of system capabilities which would otherwise be far too costly. This proposal emphasizes methodology in the application of control, estimation, and linear systems theory to problems of interest to the Air Force. Past research under this grant has shown that the transient response of some linear systems can be shaped without changing the closed loop eigenvalues by altering the closed loop eigenvectors, and an algorithm has now been developed which allows the designer to influence the magnitude of various modes in system response. This approach to control design will be analyzed and evaluated. Work will continue on recursive plant identification, developed for operation with the controller in the control loop. When this is complete an adaptive controller will be added and tested against high-order nonlinear plants. When estimating unmeasured states for system control, variations of the Kalman filter work well unless the disturbances have nonzero mean. Investigations will seek the conditions under which the state vector can be augmented and Kalman-like methods used for the nonzero mean case. Performance deterioration under various disturbance conditions would be considered.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0005, AUTO RAY-TRACE ANALYSIS

T.B. BARRETT, Parke Mathematical Labs. Inc., *Carlisle, Massachusetts* 01741 (DF900850; F19628-76-C-0029)

AF function - ionospheric propagation prediction. Deficiency - inadequate mathematical techniques are available to translate ionospheric measurements into short-term propagation predictions for long-distance communication and OHD radar. Objective - develop automation for computer ray tracing, for analysis of ray-tracing results, and for inferring the prevailing ionospheric electron distribution in the coverage region of an over-the-horizon radar by means of ray computations for trial electron distributions until the computed propagation results match the ionograms measured by the radar. How research contributes - capability for short-term predictions is required by the Air Weather Service. Knowledge of electron distribution is important for diagnostic analysis and real-time management of systems in which

radio propagation in the ionosphere plays an important role. Off-great-circle deviations, multiple propagation-path delays, signal strength, ground-backscatter modes, and backscatter by field-aligned ionization in the auroral region are considered.

Ray tracing is the basic tool for diagnosing the effects of the ionosphere on operational HF radar and communication systems, and inferring electron distribution from backscatter-radar data. Computer subroutines are developed for automating the ray-tracing user's specification of three-dimensional ionospheres, for automating analysis of ray-tracing computations, for displaying combinations of ray- computation results, and for computing signal strength in backscatter by the earth's surface and from geomagnetic field-aligned ionization. Computer core-memory requirement, the number of rays required to delineate all significant propagation effects, and the number of trial electron distributions which must be analyzed in order to infer the prevailing electron distribution giving rise to a given set of ionograms measured by the backscatter radar will be minimized.

ADDENDA: Supporting Agency Address is: Rome Air Development Center ETE, Griffiss AFB, N.Y.13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0006, COMPUTER SOLUTION OF NONLINEAR ALGEBRAIC EQUATIONS

K.M. BROWN, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (DN475372; N00014-76-C-0329)

This work will provide improved computer procedures (algorithms) for the solution of nonlinear algebraic equations. Such equations must be solved in order to describe many nonlinear physical phenomena which occur in design considereations for Navy vehicles. For example, nonlinear equations must be solved in order describe the air flow around aircraft; computational aerodynamics shows promise of supplementing and partially replacing expensive wind tunnel tests used in the design of Navy aircraft. Nonlinear equations must also be solved in the process of computer design trade-offs for almost all electromechanical systems; e.g., control systems for aircraft and missiles. In almost all cases, the present knowledge of algorithms for the solution of nonlinear equations is inadequate for the engineering applications at hand.

The principal investigator has designed 'local' algorithms which are quite effective. That is, these algorithms solve nonlinear equations if provided with a sufficiently good initial guess at the solution. The investigator will improve these algorithms so that, in a precise sense, they take the least possible computer time for a given problem. He will also implement heuristic procedures for automatically providing good initial guesses. Portable FORTRAN computer programs, which can be immediately used by Navy laboratories, will be produced.

ADDENDA: Supporting Agency Address is: Office of Naval Research, Arlington, Va 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0007, THEORY AND COMPUTER CODES FOR NON-EQUILIBRIUM PLASMAS

W.H. LONG, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF458820)

AF function - communication, tracking and navigation, weaponry. Deficiency - lack of knowledge of plasma interaction processes in gas discharges and lasers. Research - theoretical description of interaction processes in non-equilibrium gas discharges. How research contributes - improved laser systems (quality, power, stability, lifetime). Valuable information on pumping rates, laser gain, and discharge stability will be made accessible in terms of experimental quantities of discharge current, voltage, and pressure.

Three different aspects of gas discharges control their operation and govern their performance, (1) the electron energy distribution (3) diffusion (3) minority species concentration. A theoretical investigation of plasma interaction processes is undertaken accounting for these processes in a self-consistent treatment. The Boltzmann equation is numerically solved to yield electron energy distributions as a function of the ratio of electric field strength to neutral gas number density and minority species concentration. Such solutions are input to a molecular kinetics code which includes a diffusion theory calculation. The calculation will iterate to a self-consistent solution. Such a coupled system provides detailed information concerning the effects of contaminants, metastables, and gas heating on discharge operation. A continuous update of data and confirmation of modeling accuracy is achieved through close coupling with ARL-7073-05-02 and ARL 7073-05-03.

ADDENDA: Supporting Agency Address is: AF Aero-Propulsion Laboratory POD, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, ELECTRONIC PROPERTIES OF II-IV-V SEMICONDUCTORS

C.Y. FONG, Univ. of California, School of Letters & Science, *Davis, California* 95616 (DF035060; AF-AFOSR-2353-72)

Microwave electronic devices are important elements of Air Force communications and countermeasures systems. Improved performance can be expected from the use of new solid-state materials for the generation and detection of microwave signals. Present microwave solid-state device performance is limited by the properties associated with the structure of the device material. This research investigates experimentally and theoretically the electronic band structure of the anisotropic semiconductors CdSiP2, CdSnP2, CdSiAs2, and CdSnAs2. These compounds belong to a class of group II-IV-V2 compounds that have a number of interesting physical properties suggesting potential technological utility, especially for microwave devices. It is anticipated that each of these semiconductors have negative mass charge carriers. The objective of this research program is to determine if the electronic band structure of these materials exhibits sufficiently interesting negative mass states to warrant further investigations of electron transport properties to ascertain their potential for utilization in solid-state microwave amplifiers and generators.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0002, MATERIALS SUPPORT TECHNOLOGY - PHONON AND PHOTON PROCESSES IN SOLIDS

R.F. WALLIS, Univ. of California, School of Physical Sciences, *Irvine, California* 92664 (DN123370; N00014-76-C-0121)

Device work, materials preparation, and crystal growth are all areas where improved knowledge of surfaces will contribute. The interaction of phonons and photons with surfaces is one way to improve our knowledge of surfaces.

This work treats theoretically the optical properties of solids and of properties related to the existence of a free surface. The study of surface properties emphasizes lattice dynamical properties. Surface excitations known as polaritons will be studied. These include surface optical phonons, surface plasmons, and surface magnons.

ADDENDA: Supporting Agency Address is: Office of Naval Research 421, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0003, HIGH-BETA PLASMAS

A.Y. WONG, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (DF032360; AF-AFOSR-2332-72)

Knowledge of phenomena in high-beta plasmas is needed to increase understanding of processes which affect operations and communications in the upper atmosphere and space and to support work in nuclear phenomena under low density and moderate temperature conditions. A large device, high-beta plasma source is being developed for the study of collisionless collective plasma phenomena, such as waves, instabilities, and transport processes. The large device, operated in a steady-state mode, permits the use of highly sensitive probe techniques and diagnostic methods, and

allows the use of time-averaging techniques for the detection of very small signals at noise levels. The results of this research will produce a unique capability to investigate high-beta plasmas. Additional work includes production of a laser plasma from a solid target and expansion of this plasma into a high-beta plasma background.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NP, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0004, ELEMENTARY PARTICLES
R.A. SWANSON, Univ. of California, Graduate School, *San Diego, California* 92037 (PHY76-20415)

Experiments involving the detection of neutral kaons are in progress at Fermilab. 1. The electromagnetic form factor of the neutral kaon. A determination of the electromagnetic radius of the neutral kaon will be made by measuring the amplitude for short-lived neutral kaon regeneration by electrons. 2. A rigorous test of the theory of hadron dynamics relating high-energy scattering processes to known resonant particle states (triple Regge theory). A measurement of the inclusive charge exchange cross section will be made for negative kaons incident on hydrogen.

This work is a continuation of that currently supported by Foundation grant PHY72-04430A05.

SUPPORTED BY U.S. Natl. Science Foundation

8.0005, SPECTROSCOPIC AND KINETIC STUDIES OF GAS PHASE REACTIONS
H.P. BROIDA, Univ. of California, School of Letters & Science, *Santa Barbara, California* 93106 (DF039680; AF-AFOSR-2724-74)

Increased Air Force capabilities in reconnaissance, communication, and several other areas depend on developments in laser technology. Chemical lasers indicate a high probability of fulfilling these needs through their properties of different wavelengths, high-power, high operating efficiency and lower weight. The development of new and improved chemical laser systems requires an increased understanding and knowledge of the properties and characteristics of candidate reactions and molecules. This research will include studies on the kinetics of room temperature reactions of metal atoms with oxidants and halogens with specific interest in obtaining absolute photon yields and electronic-vibrational branching ratios for these reactions. Detailed mechanisms on the formation and loss of these electronically excited diatomic species will be developed. High resolution spectroscopy will be used to obtain the molecular constants for these electronically excited products as well as other molecules which are of atmospheric, combustion, and chemical laser interest.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NC, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0006, COMMUNICATIONS - RARE-EARTH GALLIUM PEROVSKITE SUBSTRATES FOR BUBBLE DOMAIN IRON PEROVSKITES
S. GELLER, Univ. of Colorado, School of Engin. & Appl. Sci., *Boulder, Colorado* 80302 (DN223864; N00014-75-C-0782)

This work is concerned with the development of improved substrates for epitaxial magnetic films with bubble domains for logic and memory devices useful to the Navy in its communications and surveillance operations.

It is proposed to grow improved rare-earth gallium perovskite substrates for bubble domain iron perovskites using the Czochralski technique. While garnet materials, grown by liquid-phase epitaxial growth or by chemical vapor deposition, is now favored for magnetic bubble technology, the perovskites have promising properties. They have higher domain wall mobilities than the garnets although the domains are larger. With improved substrates it may be possible to diminish the size of the domains to make the perovskites a superior bubble material.

ADDENDA: Supporting Agency Address is: Office of Naval Research, Arlington, Va 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0007, COLOR CENTER IN ALKALI AZIDES 13262-P
R.H. BARTRAM, Univ. of Connecticut, School of Liberal Arts & Sci., *Storrs, Connecticut* 06268 (DA0G5578; DAHC04-75-G-0128)

To determine the role of color centers in the decomposition of azides by radiation damage, in photolysis and thermal decomposition. The microscopic mechanisms of non-radiative energy transfer will also be investigated to explain the equations for the rate of photochemical decomposition of potassium azide. The azides are used extensively as primary explosives but experience shows that they are undesirably unstable. The proposed work will help determine the causes of this instability in order to assess possibilities for alternative solutions.

The proposed investigations include calculations of properties of the molecular defects N2(minus) and N4(minus) in KN3, and the excited states of the azide ion. The mechanism of non-radiative transfer of excitation energy will be investigated. Electron-lattice interactions and absorption line shapes will be studied for the electron-excess color centers F and F2(plus) in NaN3.

ADDENDA: Supporting Agency Address is: DARCOM Army Research Office, P O Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

8.0008, LOW-ENERGY INELASTIC ATOMIC AND MOLECULAR COLLISIONS 13400-P
E. POLLACK, Univ. of Connecticut, Graduate School, *Storrs, Connecticut* 06268 (DA0Z5578; DAAG29 76 G0130)

To study the physics of ion-atom and ion-molecule collisions with the goal of understanding atomic inner-shell processes for X-ray lasers and high-power chemical lasers but not limited only to these applications. The atomic inner-shell processes (X-rays, Auger and photoelectron emission) are important for a number of materials identification, testing and evaluation programs for the Army, and X-ray laser would be useful for materials research in general, for nuclear weapons effects simulations and possibly for use as a weapon. The ion- molecule experiments have potential relevance to high-power chemical laser work at AMIC.

A. Ion/photon/electron coincidence techniques will be used to determine inner-shell X-ray and Auger yields and the effect of outer- shell configurations that increase the X-ray yields for possible X-ray laser candidates. B. By investigating energy loss spectra in ion- molecule collisions, determine separability of electronic and vibrational excitations, the role of symmetries and resulting selection rules.

ADDENDA: Supporting Agency Address is: DARCOM Army Research Office, P O Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

8.0009, ANGULAR RESOLVED ELECTRON EMISSION STUDIES OF MICROWAVE MATERIALS
G.J. LAPEYRE, Montana State University, School of Letters & Sciences, *Bozeman, Montana* 59715 (DF041290; AF-AFOSR-2872-75)

AF function- modern aerospace electronic systems depend heavily upon solid-state electronic and optical devices. Opportunity - future improvement in performance of these devices requires a thorough understanding of the electronic structure and excitation processes in selected solids. Present solid-state electronic and optical devices are based upon the properties of a relatively small percentage of the total number of materials potentially available. Objective - the objective of this research program is to provide knowledge on the electronic structure, electronic transitions and interaction, and optical properties for both the bulk and surface states of materials currently under investigation for microwave devices. How work contributes - it is anticipated that this research will provide knowledge which could lead to improvement in solid-state devices that depend on surface effects such as the behavior of junctions and vapor deposited films.

This research program experimentally investigates bulk and surface electronic and optical properties of stannic oxide, aluminum oxide, III- VI semiconductors, and single-crystal metals using innovative photoemission technqiues in the 2 to 50 ev photon range, Auger electron spectroscopy, and energy band analysis.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0010, THE STABILITY, ELECTRONIC AND SURFACE PROPERTIES OF THE ALKALI AZIDES 13778-C

B.S. ROYCE, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DA0E9167; DAAG29 76 C 0054)

This proposal is concerned with the continuation and extension of experimental measurements of the thermal and optical decomposition of potassium and rubidium azide in order to elucidate the solid-state reactions processes involved. This research should provide much needed information on a class of metastable materials such as explosives, pyrotechnic ingredients, and propellant composition components.

The study will focus on the early stages of decomposition of both powder and oriented single-crystal specimens in ultra-high vacuum or controlled gas ambients. Techniques to be employed include the scanning electron microscope, the photoacoustic technique, photoluminescence, and mass spectrographic detection of decomposition products.

ADDENDA: Supporting Agency Address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

8.0011, THE PHYSICS OF SPIN-POLARIZED ATOMIC VAPORS

W. HAPPER, Columbia University, School of Arts & Sciences, *New York, New York* 10027 (DF038840; AF-AFOSR-2685-74)

AF function - the AF has a requirement for long-term, low-drift space reference systems. Opportunity - development of optically pumped frequency standards, magnetometers, and gyroscopes will benefit from study of magnetic resonance in dense vapors where spin exchange equilibrium prevails. Objective - investigation of the properties of high-density, optically pumped alkali vapors and development of ways to make use of these vapors in miniature, inexpensive devices like magnetometers and gyroscopes. Contribution - cheaper and more rugged navigation, guidance, and control devices.

This research is directed toward development of ways to optically pump a very dense alkali vapor with a laser. Advantages are that the high light flux from the laser will allow much more sensitive and rapid measurements of magnetic resonance frequencies than are feasible with conventional optically pumped systems or with conventional nuclear magnetic resonance or electron spin resonance techniques. Since gallium arsenide injection lasers are very small and potentially very inexpensive, a laser pumped magnetic resonance device can be very small and cheap compared to conventional devices, and the active volume of a device operating in the high-density regime can be very much smaller than usual.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NP,Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0012, SPECTROSCOPIC STUDIES OF THE ELECTRONIC STRUCTURE OF SEMICONDUCTOR INTERFACES

D.E. EASTMAN, Internat. Bus. Machines Corp., *Yorktown Heights, New York* 10598 (DF042670; F44620-76-C-0041)

AF function - modern aerospace electronic systems for command, control and communications, and for surveillance and reconnaissance depend heavily upon solid-state electronic and optical devices. Opportunity - future improvement in performance of these devices requires a thorough understanding of the electronic structure and excitation processes in selected solids. Objective - the objective of this research is to provide knowledge of the electronic structure, electronic transitions and interactions, and optical properties at semiconductor interfaces that are vital to microwave device operations. Approach - the electronic structure and properties of semiconductor interfaces, including metal-semiconductor Schottky barriers, of III-V semiconductors, selected group IV, II-VI and ternary III-V alloy semiconductors will be studied by a variety of techniques including photoelectric yield and photoelectric spectroscopy using synchrotron radiation, and electron energy-loss spectroscopy, Auger electron spectroscopy and low-energy electron diffraction. How work contributes -this work will provide knowledge and understanding of interface states that will permit the development of more reliable and efficient microwave devices for the above system.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0013, FLUX PINNING AND FLUX STUDIES IN SUPERCONDUCTORS USING FLUX FLOW NOISE TECHNIQUES

W.C. JOINER, Univ. of Cincinnati, School of Arts & Sciences, *Cincinnati, Ohio* 45221 (E(11-1)-2890)

OBJECTIVE: The objective of this work is to study flux pinning and the dynamics of flux flow in type II superconductors. Superconducting alloy samples will be prepared containing various metallurgical defects and exhibiting different critical current characteristics resulting from the defect structure. The flux flow noise power spectrum will be studied for each sample, and data will be obtained which will relate flux bundle size, transmit time, pinning force, and other parameters characterizing flux flow with the metallurgical sample condition.

PROPOSED PROCEDURE: Measurement of the flux flow noise spectrum as a technique for obtaining information on flux flow properties of superconductors was first suggested by van Gurp in 1966. Use of this technique has not been fully exploited, however, because workers who have reported measurements using this method have obtained results contradictory with the existing theoretical descriptions. However, preliminary measurements we have made in PbIn foil samples appear to produce a coherent picture of the flux flow process.

We believe this technique may be developed as a means of studying in a detailed way the desirability of new superconducting materials and improving the uniformity, and therefore the reliability, of long lengths of wires required in large-scale devices.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0014, PARAMETER-FREE ELECTRONIC CALCULATIONS IN CRYSTALS AND THIN FILMS

R. EUWEMA, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DF042470; F44620-76-C-0026)

AF function - electronic systems depend heavily upon solid-state electronic and optical devices. Improvement in current devices and development of new ones requires a thorough understanding of the electronic structure in electromagnetic materials. Opportunity - a major tool used in electronic structure and optical properties investigations is calculational techniques. Almost all such calculations have used approximation or were adjusted to correspond to experimental results. Objective - this research will develop a technique for complete ab initio calculations of electronic energy in crystals and thin films. The ultimate goal is to be able to accurately predict the electronic and optical properties of electromagnetic materials without the availability of experimental data. Approach - the technique is based on an unrestricted-Hartree-Fock method which requires no input of experimental data other than crystal symmetry and involves no adjustable parameters.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NE,Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0015, SEMICONDUCTOR PROPERTIES

C.W. LITTON, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF104050)

AF function - avionics, reconnaissance, surveillance, communication, and microwave generation and detection. Deficiency - lack of adequate secondary materials characterization in electronic grade gallium arsenide and other wide and narrow bandgap III-V compounds, particularly semiconductor materials used for device fabrication. The electronic semiconductor, GaAs, is presently under device development in several AF and DOD labs

for high-frequency systems, such as phased array radars and microwave signal amplifiers. Because of its high electrical mobility, GaAs is probably the most promising material available for high-frequency electronic device applications. But commercially available GaAs is still too poor in quality and purity to permit the construction of large numbers of reliable electronic devices. Poor electronic quality of commercial single crystals of GaAs is believed due, in part, to presence of unacceptable concentrations of electronic defects, such as those induced by stoichiometric deviations as well as foreign impurity atoms. Need for more sensitive analytical techniques for detection and analysis of small concentrations of electronic defects in GaAs and other III-V semiconductors used in AF electronic devices. How research contributes - provides new impurity analytical techniques via high-resolution laser-pumped photoluminescence and bound exciton spectroscopy of proven high sensitivity for the purpose of analyzing low concentrations of electronic defects in GaAs and other III-V semiconductors; advises manufacturers as to what level of impurity concentrations can be tolerated and how costs can be reduced in preparation of semiconductor device materials.

To perform high-resolution optical and magneto-optical spectroscopy on high-purity, high-mobility, n and p-type GaAs epitaxial layers and chips (provided by MIT Lincoln Labs) which will be used as spectral standards for analysis of electronic defect concentrations. Similar measurements will be performed on impurity-doped, vapor-phase and liquid-epitaxy GaAs layers which are used in various microwave and FET devices and which are provided by various manufacturers. Spectral impurity measurements will also be performed on Cr-doped, semi- insulating GaAs substrate wafers for purpose of identifying troublesome impurities and defects. Spectral analysis will also be performed on InP epilayers and substrates (used for devices). (Text Abridged).

SUPPORTED BY U.S. Dept. of Defense - Air Force

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, DEVELOPMENT ALTERNATIVES IMPACTED BY COMMERCIAL AIRPORTS
UNKNOWN, Rensselaer Polytechnic Inst., Graduate School, *Troy, New York* 12181 (H-2358)

OBJECTIVES: Research grant for doctoral dissertation: Citizen Participation Demonstration: An interactive stimulation exercise on residential and other land-use development alternatives impacted by commercial airports.

SUPPORTED BY U.S. Dept. of Housing & Urban Development

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, INTERPLANETARY FIELD STUDY
K.I. ANDERSON, Univ. of California, Space Sciences Laboratory, *Berkeley, California* 94704 (DF247230; F19628-76-C-0125)

AF function - communications and detection. Deficiency - understanding ionospheric effects caused by various auroral phenomena which cause communications degradation in the arctic. Objective - investigate the effects of the interplanetary magnetic field with various auroral phenomena and their problems. How research contributes - provides inputs to in-house work efforts in substorm prediction and ionospheric mapping. This contractual effort is for investigation of the IMF and its relationship to various auroral phenomena and the predictive indications inherent in the IMF behavior. Interpretation of IMF parameters in terms of auroral phenomenology provides a background for the interpretation of data collected by the AFCRL Airborne Ionospheric Observatory, NKC-135 S/N 53131.

Assemble and interpret IMF data to specify a given ionospheric state and structures associated with the chosen state. To correlate the specific states and structures with DMSP photos and aircraft data. To identify any precursor states or structures which warn of impending substorms or other magnetic disturbances.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory PH, L G Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

10.0002, A STUDY OF FLARES THAT OCCUR BETWEEN ADJACENT ACTIVE REGIONS
S.S. MARTIN, Calif. State Univ. & Colleges, Graduate School, *Northridge, California* 91326 (DF044490; AF-AFOSR-3068-76)

AF function - this research will contribute to the existing Air Force requirement for the capability to predict solar flares. Deficiency - in spite of many years of research into the cause of solar flares and the source of their energy, there is still no definite explanation of the physical processes involved in these events. Objective - this research will involve a study of a particular subset of flares, i.e., those occurring between adjacent active regions. The logic behind this is that studying a smaller group will reduce the number of variables necessary to quantify the physical parameters in flares. Contribution - success in this research could lead to an understanding of the physical mechanisms involved in initiating and providing the driving energy in a particular type of flare which in turn could lead to a general understanding.

This study will involve an observational and theoretical study of the subset of flares which occur at the boundaries between adjacent active regions. This subset of flares is chosen because it offers the unique possibility of observationally defining conditions when flares will definitely not occur between initially separate active regions versus conditions when the occurrence of flares is highly probable at these same locations. Theoretical study of this same subset of flares also is attractive because these flares can occur when the adjacent active regions have simple bipolar magnetic field configurations.

ADDENDA: Supporting Agency Address is: AF Office of Scientific Research NP, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

10.0003, X-RAY ENVIRONMENTAL LIMITS TO MILITARY SYSTEMS HARD X-RAY AND GAMMA RAY ASTRONOMY
J.D. KURFESS, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN480107)

To monitor the hard X-ray and gamma-ray environment in the upper atmosphere and in space, including solar emission, cosmic gamma-ray bursts, intense celestial sources and the atmospheric/ magnetospheric background. Solar gamma-ray emission is of interest because of the potential for an improved prediction capability for flare-related communications disturbances. Improved detection capabilities are also required for monitoring high-altitude nuclear tests and for satellite inspection.

Multi-crystal scintillation detectors (phoswiches) and other nuclear radiation detectors are flown on stratospheric balloons, rockets, and are being developed for satellite applications. High-resolution germanium detectors are under evaluation for future use. A balloon-borne system capable of around-the-world flight durations of 100 days or longer being developed for use with superpressure balloons.

ADDENDA: Supporting Agency Address is: Naval Research Laboratory (7000), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0004, SURVEILLANCE - LASER LUNAR RANGING
C. ALLEY, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (DN223043; N00014-72-C-0045)

This laser will be used for surveillance of earth tides and moon librations by accurate measurements of the distance between a given location on the earth's crust and fixed points on the moon's surface, the motions of the moon relative to the earth, earth tide, and the continental drift theory can be checked. This scheme could also be used for a high accuracy position locator or navigation scheme.

A mode-locked laser oscillator built under contract N00014-70-C- 0342 will be used to drive an amplifier and frequency doubler, thereby producing a subnanosecond pulse whose time of flight to a retroreflector placed on the moon and back will be used to accurately measure the distance to the moon.

ADDENDA: Supporting Agency Address is: Office of Naval Research 421, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0005, SOLAR, GALACTIC AND EXTRAGALACTIC RADIO ASTRONOMY AT THE CLARK LAKE RADIO OBSERVATORY

W.C. ERICKSON, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (AST70-01638 A09)

Multifrequency maps of radio emission from the solar corona will be made to help understand and predict solar-terrestrial disturbances. Maps in two polarizations will be useful in determining the large-scale magnetic field structures above flare regions and in understanding energetic particle acceleration processes. Coronal holes and the transition region between the corona and the interplanetary medium where corotation of the corona with the sun ceases will be studied.

Non-solar radio sources will be observed to accurately establish fluxes and spectra throughout the wavelength range from 3 to 15 meters. Observations of the compact and variable sources will help to identify the energy generation processes and radio emission processes that predominate at decametric wavelengths. The strong correlation between X-ray emission and decametric emission will be examined and new classes of radio sources that have been observed only at decametric wavelengths will be identified.

The system consists of 720 conical log spiral (Teepee) antennas arranged in a Tee of 3 kilometers aperture, electronically steerable in both hour angle and declination and tunable to any frequency between 10 and 125 MHz. It is now operating in a dual-beam mode with a two-channel receiver and simple computer control system. The instrumental work will culminate in a multifrequency radioheliograph and earth-rotation synthesis telescope.

SUPPORTED BY U.S. Natl. Science Foundation

10.0006, SOLAR PARTICLE MODELING 1.1

M.A. SHEA, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF241510)

AF function - communications and surveillance. Deficiency - inability to predict to the required accuracy solar particle effects on the atmosphere and ionosphere. Objective - to obtain an understanding of solar particle propagation through the interplanetary medium to the magnetosphere and the propagation and distribution through and within the magnetospheric cavity. This effort is directed toward developing techniques to predict the solar particulate radiation in the environment where USAF systems operate. How research contributes - will define parameters required for prediction of the aerospace environment. This necessitates an understanding of the production and release of solar particles at the sun, their propagation through the interplanetary medium to the magnetosphere and their distribution through the magnetospheric cavity to satellite altitudes and the polar ionosphere where they significantly affect communication parameters and military systems operating in this environment. The research is directed toward providing reliable prediction techniques for operational use since current theories are insufficinet to permit adequate prediction of solar particles, their propagation within the interplanetary medium or the transmission characteristics of these particles through the magnetosphere to the environment in which USAF systems operate.

Collect and assemble solar particle and related solar-terrestrial data from all available sources. Order these data by various solar and interplanetary phenomena in an effort to construct a model of solar particle increases expected at the earth. Develop a technique for predicting solar particle enhancements in the environment where USAF systems operate. This prediction technique will attempt to include the prediction of the particle onset, and the time/intensity profile expected for a specific event given specific, defined, and obtainable parameters. Compare the predicted time/intensity profile with actual observations in an attempt to resolve anomalies.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory PH, L G Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

10.0007, SOLAR WIND ANALYSIS

H.S. BRIDGES, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DF245450; F19628-75-C-0131)

AF function - communications, surveillance and satellite operations. Deficiency - incomplete knowledge of processes connecting solar phenomena with upper atmosphere and near-earth environment. Objective - define the prevailing processes and develop prediction schemes. How research contributes - relating solar wind and observed energetic particle fluxes observed by satellite with terrestrial and/or near-earth operational problems leads to understanding of problem and ultimate solution.

Solar wind data from the satellites SOLRAD 11 will be obtained from the naval research laboratories and compared with other SOLRAD data, particularly AFCRL proton sensors. These will be compared with each other and with observations from ground sources and other satellites. These results will contribute to our understanding of the phenomena.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory PH, L G Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

10.0008, SOLAR ATMOSPHERIC DYNAMICS

R. STEIN, Brandeis University, School of Arts & Sciences, *Waltham, Massachusetts* 02154 (DF243110; F19628-75-C-0013)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate solar disturbance predictions. Research - optical studies of solar activity. How research contributes - provides data on the driving of the solar atmospheric oscillation and heating of the chromosphere and corona. Approach - the researcher proposes to calculate the driving of the solar atmospheric oscillation by thermal overstability of acoustic and magnetic modes in the super-adiabatic convection zone and the propagation, refraction and dissipation of these oscillations in the chromosphere and corona. This work directly supports the solar energy transport effort under work unit 76490605.

ADDENDA: Supporting Agency Address is: AF Geophysics Laboratory PH, L G Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

10.0009, THE STRUCTURE OF PLANETARY ATMOSPHERES

T.M. DONAHUE, Univ. of Michigan, School of Lit. Sci. & the Arts, *Ann Arbor, Michigan* 48104 (ATM75-21049 A01)

This Grant funds interdisciplinary studies aimed at the understanding of planetary atmospheres. In the context of the group involved, this definitely includes the atmosphere of the third planet, earth. The work of Dr. Donahue and colleagues will be directed toward the physical modeling which brings together and maximizes the utility of work by a number of able researchers at the University of Michigan. The past results give promise of continued success.

SUPPORTED BY U.S. Natl. Science Foundation

10.0010, GRAVITATION, RELATIVITY AND COSMOLOGY

D.T. WILKINSON, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (PHY76-11446)

Theoretical and experimental research on gravitation, relativity, and cosmology initiated under NSF grant PHY71-03266 A04 will be continued.

The experimental group will apply novel instrumental and analytical techniques to obtain data from the celestial laboratory. Theoretical research will explore mathematical aspects of classical and quantum gravitation theory. Topics to be investigated include: Experimental-- (1) Improved determination of the isotropy

of the microwave background radiation using newly developed ground-based and balloon-borne radiometers. (2) Study of galaxies in the far red to search for primeval galaxies and the systematic properties of elliptical galaxies. (3) Analysis of clustering of galaxies to uncover information on their creation and evolution. (4) Measurement of the cosmic light intensity from unresolved extragalactic sources to provide constraints on the theory of evolution of galaxies in the early universe and the presence of unknown sources.

Theoretical--(1) Study of Constrained Hamiltonian systems to provide a framework for a wide variety of physical systems. (2) Canonical quantization of gravitation and other gauge fields and its consequences on ideas of causality and gravitational collapse.

SUPPORTED BY U.S. Natl. Science Foundation

10.0011, CONTINUED PHOTOMETRY OF APPARENT CHANGES IN HDE 226868 (CYGNUS X-1)
R.J. DONNELLY, Univ. of Oregon, School of Liberal Arts, *Eugene, Oregon* 97401 (AST76-15447)

Observations of the star system HDE 226868 at the Universiy of Oregon's Pine Mountain Observatory constitute one of two extensive observatory photometric records of HDE 226868 acquired since the discovery of its periodic light variations in 1972. This star system is the optical counterpart of the celestial x-ray source Cygnus X-1. There exist puzzling differences between the light curve results of U.S. based observations and the extensive measurements done in Spain by N. Walker of the Royal Greenwich Observatory. This lack of experimental consensus is now compounded by clear evidence of a 'non-stationary' statistical difference in the light curve between 1974 and 1975. The proposed work in this project will strengthen the photometric coverage of HDE 226868. All photometric data obtained to date will be assembled and analyzed. The results will detail the physical characteristics and the behavior of the components of this binary system.

SUPPORTED BY U.S. Natl. Science Foundation

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N77-13975# Maryland Univ., College Park.
AIR TRANSPORTATION FOR THE 1980'S. COLLECTED PAPERS OF 1975 - 1976 SEMINAR SERIES
R. M. Rivello, ed. Jun. 1976 384 p Presented at The 1975 - 1976 Seminar on Air Transportation for the 1980's, College Park, Maryland, Oct. 1975 - Apr. 1976
Avail: NTIS HC A17/MF A01

The purpose of the series was to: determine the requirements for the next generation of transport aircraft, identify research areas that are relevant to these aircraft, survey the state of the art in these areas, and determine what new technologies must be developed to meet future requirements. Seminar speakers were invited from the airlines, the airframe and engine manufacturers, and from government research and regulatory agencies. It was decided to limit the seminars to topics that relate to the design of the vehicle. The first three papers deal with requirements, the market for new aircraft, and the environmental restrictions that will be placed upon them. The next five papers describe the current and projected technologies in the fields that are applicable to the next generation of designs. These cover aerodynamics, propulsion, structures and materials, flight control systems, and rotary wings. The final paper looks at the far field developments that are likely to occur beyond the 1980's. For individual titles, see N77-13976 through N77-13984.

N77-13976# American Airlines, Inc., New York.
FUTURE AIRCRAFT REQUIREMENTS: A NOTEBOOK OF AIRLINE THOUGHTS **c05**
Richard J. Linn *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 1-29 Presented at College Park, Md. 17 Feb. 1976 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

The economic condition of the air transportation industry and its effect on future technology in commercial aviation are discussed. L.S.

N77-13977# European Aerospace Corp., Washington, D. C.
A EUROPEAN POINT OF VIEW **c03**
Piere Marion *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 31-51 Presented at College Park, Md. 2 Mar. 1976 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

The constraints hampering present and future development of aircraft are discussed. Some possible solutions to these problems are given. L.S.

N77-13978# Department of Transportation, Washington, D.C.
CLIMATIC IMPACT **c45**
Alan J. Grobecker *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 53-114 refs Presented at College Park, Md. 3 Feb. 1976 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

A discussion is presented of whether impurities from flights of aircraft high in the stratosphere could alter the proportions of atmospheric trace constituents with harmful results to the earth's environment. L.S.

N77-13979# Boeing Aerospace Co., Seattle, Wash.
AERODYNAMIC DESIGN **c05**
Ian H. Rettie *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 115-152 Presented at College Park, Md. 14 Oct. 1975 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

The aerodynamic design of the wide-body type aircraft is discussed with a view toward better performance and more efficient commercial services. L.S.

N77-13980# Pratt and Whitney Aircraft, East Hartford, Conn. Engineering Dept.
AIR TRANSPORT PROPULSION FOR THE 1980'S **c07**
J. W. Witherspoon *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 153-225 Presented at College Park, Md. 11 Nov. 1975 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

Turbofan engine technology is discussed for use in present and future wide-body aircraft. L.S.

N77-13981# Douglas Aircraft Co., Inc., Santa Monica, Calif.
STRUCTURES AND MATERIALS **c05**
Melvin Stone *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 227-264 Presented at College Park, Md. 2 Dec. 1975 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

Aircraft design is discussed with emphasis on structural improvements of advanced composites. A 'state of the art' is given for aircraft structures and materials. L.S.

N77-13982# Lockheed-Georgia Co., Marietta.
EFFECTS OF ARTIFICIAL STABILITY ON CONFIGURATION DESIGN **c08**
Roy H. Lange *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 265-315 refs Presented at College Park, Md. 23 Mar., 1976 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

Applications of advanced technology to the design of future transport aircraft show the potential to provide significant improvements in performance and economics of such aircraft. A presentation is given to identify current activities in active controls, describe the preliminary design integration process, and discuss applications of active controls technology in design including a specific redesign study conducted on the Lockheed JetStar airplane. Author

N77-13983# United Aircraft Corp., East Hartford, Conn.
ADVANCED HELICOPTER DESIGNS **c05**
Raymond F. Donovan *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 317-352 Presented at College Park, Md. 6 Apr. 1976 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

Techniques are discussed as solutions to problems pertaining

to helicopter design. A 'state of the art' is given on helicopter design. L.S.

N77-13984*# National Aeronautics and Space Administration, Washington, D.C.
AIR TRANSPORTATION BEYOND THE 1980'S c03
Gerald G. Kayten *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 353-380 refs Presented at College Park, Md. 20 Apr. 1976 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

An oral preview of the air transportation sections of the NASA Outlook for Aeronautics study report is presented. Now published, the study report covers military as well as civil aviation and also discusses the role of NASA in support of future developments. The study is based largely on inputs from industry, universities, and other government agencies. Author

N77-13985*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SCANNING LASER-VELOCIMETER SURVEYS AND ANALYSIS OF MULTIPLE VORTEX WAKES OF AN AIRCRAFT
Victor R. Corsiglia and Kenneth L. Orloff Aug. 1976 33 p refs
(NASA-TM-X-73169; A-6750) Avail: NTIS HC A03/MF A01 CSCL 01A

A laser velocimeter capable of rapidly scanning a flow field while simultaneously sensing two components of the velocity was used to measure the vertical and streamwise velocity structure 1.5 spans downstream in the wake of a model typical of a large subsonic transport (Boeing 747). This flow field was modeled by a superposition of axisymmetric vortices with finite cores. This theoretical model was found to agree with the measured velocities everywhere except where two vortices were in close proximity. Vortex strengths derived from the span loading on the wing as predicted by vortex-lattice theory also agree with the present measurements. The axisymmetric vortex model used herein is a useful tool for analytically investigating the vortex wakes of aircraft. Author

N77-13986*# Scientific Translation Service, Santa Barbara, Calif.
HISTORY OF MESSERSCHMITT AIRCRAFT CONSTRUCTION
J. B. Kaiser Washington NASA Dec. 1976 48 p refs Transl. into ENGLISH of "Die geschichte des messerschmitt-flugzeugbaus", Deutsche Luft- und Raumfahrt, Mittellung 75-21, Braunschweig, Oct. 1975 p 3-41
(Contract NASw-2483)
(NASA-TT-F-17355) Avail: NTIS HC A03/MF A01 CSCL 01B

A report on the life of Willy Messerschmitt and the history of his firm is given. Author

N77-14138# Appleton Lab., Slough (England).
TRANSATLANTIC BALLOON FACILITY
J. T. Delury, G. W. Luscombe, D. Ramsden (Southampton Univ.), and R. E. Baker (Southampton Univ.) *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 265-278 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14139# Centre National d'Etudes Spatiales, Toulouse (France).
THE USE OF FRENCH BALLOONS FOR SCIENTIFIC RESEARCH [LES BALLONS FRANCAIS AU SERVICE DE LA RECHERCHE SCIENTIFIQUE]
A. Soubrier *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 279-281 In FRENCH (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N77-13987*# Sybucon, Inc., Atlanta, Ga.
FURTHER STUDIES OF UNSTEADY BOUNDARY LAYERS WITH FLOW REVERSAL
John F. Nash Washington NASA Dec. 1976 106 p refs (Contract NAS2-8771)
(NASA-CR-2767) Avail: NTIS HC A06/MF A01 CSCL 01A

One set of calculations was performed using the first order, time dependent turbulent boundary layer equations, and extended earlier work by Nash and Patel to a wider range of flows. Another set of calculations was performed for laminar flow using the time dependent Navier-Stokes equations. The results of the calculations confirm previous conclusions concerning the existence of a regime of unseparated flow, containing an embedded region of reversal, which is accessible to first order boundary layer theory. However, certain doubts are cast on the precise nature of the events which accompany the eventual breakdown of the theory due to singularity onset. The earlier view that the singularity appears as the final event in a sequence involving rapid thickening of the boundary layer and the formation of a localized region of steep gradients is called into question by the present results. It appears that singularity onset is not necessarily preceded by rapid boundary layer thickening, or even necessarily produces immediate thickening. Author

DATA SUMMARY: Various amplitudes and oscillatory flows were measured; variables are wall shear stress distributions, displacement thickness, reversed point movement, singularity onset, oscillatory flows, pressure gradients, velocity profiles, vorticity; 52 figures include numeric data.

N77-13988*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY STUDY OF EFFECTS OF WINGLETS ON WING FLUTTER
Robert V. Doggett, Jr. and Moses G. Farmer Washington Dec. 1976 25 p refs
(NASA-TM-X-3433; L-10963) Avail: NTIS HC A02/MF A01 CSCL 01A

Some experimental flutter results are presented over a Mach number range from about 0.70 to 0.95 for a simple, swept, tapered, flat-plate wing model having a planform representative of subsonic transport airplanes and for the same wing model equipped with two different upper surface winglets. Both winglets had the same planform and area (about 2 percent of the basic-wing area); however, one weighed about 0.3 percent of the basic-wing weight, and the other weighed about 1.8 percent of the wing weight. The addition of the lighter winglet reduced the wing-flutter dynamic pressure by about 3 percent; the heavier winglet reduced the wing-flutter dynamic pressure by about 12 percent. The experimental flutter results are compared at a Mach number of 0.80 with analytical flutter results obtained by using doublet-lattice and lifting-surface (kernel-function) unsteady aerodynamic theories. Author

DATA SUMMARY: Mass properties and natural frequencies of three wing models; variables are Mach number, winglet weight/wing weight ratio, wing portion (kg, slugs), modes, basic wing, light winglet, heavy winglet; 5 figures include numeric data.

N77-13989*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WING SURFACE-JET INTERACTION CHARACTERISTICS OF AN UPPER-SURFACE BLOWN MODEL WITH RECTANGULAR EXHAUST NOZZLES AND A RADIUS FLAP
Alvin M. Bloom (George Washington Univ.), William C. Hohlweg (George Washington Univ.), and William C. Sleeman, Jr. Washington Dec. 1976 82 p
(NASA-TN-D-8187; L-10410) Avail: NTIS HC A05/MF A01 CSCL 01A

The wing surface jet interaction characteristics of an upper surface blown transport configuration were investigated in the Langley V/STOL tunnel. Velocity profiles at the inboard engine center line were measured for several chordwise locations, and chordwise pressure distributions on the flap were obtained. The model represented a four engine arrangement having relatively high aspect ratio rectangular spread, exhaust nozzles and a simple trailing edge radius flap. Author

DATA SUMMARY: Diverse data are presented; variables are static pressure distribution, jet exit velocity, static jet velocity, pressure profiles, nondimensional velocity profiles, thrust, radius flow, survey-rake location.

N77-13990*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF 45 DEG SWEPT WINGS AT MACH APPROXIMATELY 0
John E. Lamar Sep. 1976 46 p
(NASA-TM-X-73942) Avail: NTIS HC A03/MF A01 CSCL 01A

Wind tunnel tests were conducted in the Langley 7 x 10 foot wind tunnel at Mach numbers less than 0.20 and at Reynolds numbers less than 3.74 million. The effect of the aft area on the 45 deg swept wing longitudinal aerodynamic characteristics at low subsonic speeds and at an angle of attack range from approximately -2 deg to 28 deg was studied. The data are presented without analysis. Author

DATA SUMMARY: Significance of planform shaping on the vortex flow aerodynamics of moderately swept wings; variables are Mach number, lift coefficient, drag coefficient, pitching moment coefficient, angle of attack; 4 figures and 3 tables include numeric data.

N77-13991# Systems Research Labs., Inc., Newport News, Va. Rasa Div.
AN EXPERIMENTAL INVESTIGATION OF VORTEX FLOW CONTROL FOR HIGH LIFT GENERATION Interim Report, 1 Jan. - 31 Dec. 1975
Richard P. White, Jr. and John C. Balcerak Dec. 1975 210 p refs
(Contract N00014-74-C-0091; NR Proj. 212-223)
(AD-A027524; RASA/SRL-14-76-2; ONR-CR212-223-2) Avail: NTIS HC A10/MF A01 CSCL 20/4

An experimental research program was conducted to investigate methods of improving the performance characteristics of low-aspect ratio, swept-wing surfaces in the post-stall region. Wind tunnel tests were conducted with an unmodified wing panel and with snags, strakes and combinations thereof affixed to the panel. The prediction of changes in the performance characteristics by simplified theoretical analyses is discussed with regard to the observed complexity of the flow field produced by the vortex generators. GRA

DATA SUMMARY: Diverse data are presented; variables are percent span, angle of attack, drag coefficient, lift coefficient, pitching moment coefficient, yawing moment coefficient, rolling moment coefficient, spanwise station percent, chordwise station percent.

N77-13992# Tennessee Univ. Space Inst., Tullahoma.
AERODYNAMIC PERFORMANCE OF MISSILE CONFIGURATIONS AT TRANSONIC SPEEDS INCLUDING THE EFFECTS OF A JET PLUME Technical Report, May 1971 - Sep. 1975
J. M. Wu, T. H. Moulden, and N. Uchiyama 18 Feb. 1976 221 p refs
(DA Proj. 1W3-62303-A-214)
(AD-A027692; RD-76-23) Avail: NTIS HC A10/MF A01 CSCL 14/2

This report discusses the flow over various missile configurations with and without fins. Attention has been restricted to transonic flight conditions and to slender bodies at small incidence. Various rear-end geometries are treated, including boattail and flare configurations. The effect of plume induced separation is also included so that realistic estimates of the forces on the body can be made. It is shown that the agreement between theory and experiment is adequate for engineering calculations. Author (GRA)

DATA SUMMARY: Diverse data are presented; variables include Mach number, Reynolds number, surface pressure distribution, angle of attack, drag coefficient, life coefficient, total body length, load distribution, flow distribution.

N77-13993# Naval Ship Research and Development Center, Bethesda, Md. Performance Dept.
SEAKEEPING EVALUATION OF THE JOINT ARMY/NAVY BALLOON TRANSPORT SYSTEM Final Report
David M. Gerzina May 1976 24 p refs
(AD-A026032; SPD-687-01) Avail: NTIS HC A02/MF A01 CSCL 15/5

During the evaluation of the joint Army/Navy Balloon Transport System conducted off of Green Beach, Ft. Story, Virginia, the David W. Taylor Naval Ship Research and Development Center (DTNSRDC) was tasked to measure ship motions on some of the vessels used in the operation. The vessels instrumented by DTNSRDC were the Army's BDL 'LT. COL. JOHN U. D. PAGE,' the LST 1180 'USS MANITOWOC,' and two Navy LCUs of the 1610 series (1658 and 1659). Two principal configurations to remove Milvan containers from the vessels were investigated. The first was a ship to shore maneuver for which DTNSRDC instrumented the BDL and the LCU 1659. The second was a ship to lighter operation for which DTNSRDC recorded ship motions on the LST 1180 and the LCUs 1658 and 1659. Throughout the operations, the motions of the vessels investigated were, in general, rather small with the largest motions occurring aboard the LCUs when they were fendered off of the larger BDL and LST with Yokohama pneumatic fenders. The vessel motions were not the limiting factor in the operation of the balloon transfer system. Observations indicated that the ability to get the vessels into the proper position and weather operational limits of the balloon were of greater significance in the successful transfer of Milvan containers from the vessels. Author (GRA)

DATA SUMMARY: Ship motion in correlation with structural weight and wave effects; variables are wave amplitude, wave height, wave frequency, structural configurations; 4 figures and 4 tables include numerical data.

N77-13994# Naval Surface Weapons Center, Dahlgren, Va.
SIMPLIFIED SOLUTION OF THE COMPRESSIBLE SUBSONIC LIFTING SURFACE PROBLEM
J. W. Purvis May 1976 36 p refs
(AD-A027514; NSWC/DL-TR-3487) Avail: NTIS HC A03/MF A01 CSCL 01/3

A new technique for determining the spanwise and chordwise distribution of load on thin finite wings in compressible subsonic flow is presented. The method is based on the application of planar lifting surface theory. Classical theoretical results are used to define functions for the pressure coefficient distribution, and a new technique is presented for evaluating the kernel function integral. Analytical results are compared with experimental data and with solutions from a standard numerical integration method of applying lifting surface theory. Excellent correlation with experimental results is obtained for Mach numbers up to 0.80 to 0.85 for thin wings. Advantages of the new technique as opposed to other methods are also presented. GRA

DATA SUMMARY: Prediction of aerodynamic load distribution using integral equation; variables are chordwise pressure distribution, spanwise pressure distribution, aerodynamic loads, Mach number, lift curve slope, downwash distribution; 6 figures include numeric data.

N77-13995# Nielsen Engineering and Research, Inc., Mountain View, Calif.
INVESTIGATION OF AERODYNAMIC LOADS AT SPIN ENTRY Annual Report, 1 Apr. 1975 - 1 May 1976
Selden B. Spangler and Marnix F. E. Dillenius 28 May 1976 37 p refs
(Contract N00014-74-C-0344; NR Proj. 212-225; RF41411801)
(AD-A026989; NEAR-TR-117; ONR-CR212-225-2) Avail:

NTIS HC A03/MF A01 CSCL 01/1

The second year's work is summarized on an investigation of the aerodynamic load distribution on fighter-bomber type aircraft at incipient spin entry flight conditions. The principal tasks were development of an asymmetric vortex-lattice computer program for a wing-body in combined pitch and sideslip and water tunnel tests on realistic aircraft nose models. The technical approach on the vortex-lattice program is described, and typical calculative results are shown. The tunnel test program is described. A cooperative test program between ONR and Langley Research Center, NASA, to obtain simultaneous force and moment and flow field measurements on a generalized figher model at high angles of attack is described. Computer methods have been developed for vortex shedding from circular noses, for the wing-body loads induced by an arbitrary distribution of nose vortices, and for afterbody and tail loads. The principal missing features are noncircular nose effects and detailed experimental data to check the methods. Author (GRA)

DATA SUMMARY: Normal force and rolling moments of swept and rectangular wings including those of the F-4 aircraft; variables are normal force coefficient, angle of attack, circulation strength; 7 figures include numeric data.

N77-13996# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.

RESEARCH ON HYPERSONIC AERODYNAMICS Final Report, 1 Jan. 1971 - 31 Dec. 1975

S. M. Bogdonoff, F. R. Hama, S. H. Lam, J. A. Smith, and I. E. Vas 5 May 1976 66 p refs

(Contract F44620-71-C-0032; AF Proj. 9781)

(AD-A027688; AFOSR-76-0812TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

The theoretical and experimental studies carried out by the Gas Dynamics Laboratory as part of its long range research in hypersonic flows have been summarized for the period 1 January 1971-31 December 1975. These studies provide some fundamental and some practical insights into real flow phenomenon observed in nature and in flight. Some of the studies have been completed, others require further work to fully understand them or to limit the range of applicability of available theories. Author (GRA)

DATA SUMMARY: Comparison of hypersonic turbulent flow fields, cavity flows, and ionized flows considering plates and cones; variables include pressure distribution, shock shape, heat profiles, angle of attack, surface pressure, density profile, flow angle, shock layer, pitot pressure; 22 figures include numeric data.

N77-13997# Aeronautical Research Associates of Princeton, Inc., N.J.

INTERACTIONS AND MERGING OF LINE VORTICES Final Report, 1 Jan. - 31 Dec. 1975

Alan J. Bilanin, Richard S. Snedeker, and Milton E. Teske Feb. 1976 47 p refs

(Contract F44620-75-C-0051; AF Proj. 9781)

(AD-A027717; ARAP-276; AFOSR-76-0873TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

The results of a theoretical and experimental study of the interactions between adjacent line vortices are presented. Particular emphasis is given to the process of merging or pairing in which two vortices of like sign coalesce to form a single vortex. Merging is discussed in terms of its importance to the growth and aging of turbulent shear layers and aircraft wakes. Flow visualization experiments are described in which merging was observed by means of smoke injected into a wind tunnel flow. Vortex pairs of like sign and equal strength, varying sign and strength, and opposite sign and equal strength were studied. Good qualitative agreement is found between the observed flow patterns and those calculated by means of a computer code. GRA

DATA SUMMARY: Vorticity distribution, vortex merging and aircraft wake aging; variables are vortices, turbulent wakes, flow distribution, aircraft wakes, laminar mixing, turbulent mixing, angle of attack, kinetic energy; 15 figures include numeric data.

N77-13998# Frankford Arsenal, Philadelphia, Pa.

WAKE REGION PERTURBATION FOR BASE DRAG REDUCTION

Walter J. Puchalski and James F. Kowalick 1976 6 p refs (AD-A026147) Avail: NTIS HC A02/MF A01 CSCL 19/4

Fumer technology promises beneficial results in terms of imparting terminal effects characteristics to selected ammunition. Fumers should not be employed, however, strictly to reduce time of flight. Fumer projectiles at a selected range have considerably higher striking energy, and should therefore be considered for use where marginal penetration performances are expected. An optimized fumer round would ideally have some degree of programmed burning of the pyrotechnic composition inherent in its design. A good fumer must produce low molecular weight gases at very high temperatures. Generally speaking, the use of fumers makes sense if the projectile in question is optimized with respect to its contour (low drag shape). A practical compromise would appear to be a ballistically sound projectile having an optimized contour (low drag shape) and a tracer element which serves both as a fire control aid (bright tracer) and as a fumer. GRA

DATA SUMMARY: No numeric data are presented.

N77-14140# Winzen Research, Inc., South St. Paul, Minn.

PROGRESS IN SCIENTIFIC BALLOON TECHNOLOGY

Otto Winzen *In* ESA European Programmes on Sounding-Rocket and Ballloon Res. in the Auroral Zone 1976 p 283-293 (For primary document see N77-14120 05-12)

Avail: NTIS HC A24/MF A01

N77-14141# Marconi Space and Defence Systems Ltd., Camberley (England).

THE DEVELOPMENT AND PERFORMANCE OF THE MSDS STABILISED BALLOON PLATFORM

J. How *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 295-306 refs (For primary document see N77-14120 05-12)

Avail: NTIS HC A24/MF A01

N77-14142# Dornier-System G.m.b.H., Friedrichshafen (West Germany).

SPEKTROSTRATOSKOP: A STABILISED BALLOON GONDOLA

K. Ernsberger, B. Koesters, H. Meier, and D. Schnebel *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone. 1976 p 307-312 (For primary document see N77-14120 05-12)

Avail: NTIS HC A24/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N77-13977# European Aerospace Corp., Washington, D. C.

A EUROPEAN POINT OF VIEW

Piere Marion *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 31-51 Presented at College Park, Md. 2 Mar. 1976 (For primary document see N77-13975 05-01)

Avail: NTIS HC A17/MF A01

N77-13984*# National Aeronautics and Space Administration, Washington, D.C.

AIR TRANSPORTATION BEYOND THE 1980'S

Gerald G. Kayten *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 353-380 refs Presented at College Park, Md. 20 Apr. 1976 (For primary document see N77-13975 05-01)

Avail: NTIS HC A17/MF A01

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N77-13999# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A DIGITAL CONTROLLER FOR HORIZONTAL ANGULAR MOTION OF THE FJSRL SEISMIC ISOLATION PLATFORM M.S. Thesis

Martin J. Burkhart Jun. 1976 122 p refs

(AD-A027433; GE/EE/76-6) Avail: NTIS HC A06/MF A01 CSCL 17/7

This study is part of a continuing effort to develop a stochastic controller for the angular motion about a horizontal axis of the Seismic Isolation Platform at the Frank J. Seiler Research Laboratory. The design of a digital controller is investigated based on the assumption that a Kalman filter would provide sufficiently accurate estimations of the states of the system. The design specifications are to maintain angular position within + or - 0.001 arcseconds and angular velocity within + or - 1.6 x 0.00001 arcseconds per second for a step function of 1.25 ft-lbs applied to the platform. Discrete models for the platform and two actuators are developed. The discrete models are used to design a controller for each actuator. A controller for the pneumatic actuator is designed to force the platform to a zero steady-state position. An optimal controller, which regulates the closed pneumatic loop, is designed for the shaker actuator. A theoretical evaluation of the control system shows angular position is maintained within + or - 2.81 x 0.0001 arcseconds and angular velocity has a peak overshoot of 2.24 x 0.01 arcseconds per second but settles to within the design specification in 0.08 seconds. GRA

N77-14000# Lincoln Lab., Mass. Inst. of Tech., Lexington.

DEVELOPMENT OF A DISCRETE ADDRESS BEACON SYSTEM Quarterly Technical Summary, No. 18, 1 Apr. - 30 Jun. 1976

1 Jul. 1976 40 p

(Contracts DOT-FA72WAI-261; F19628-76-C-0002)

(AD-A030368/5; FAA-RD-76-126) Avail: NTIS HC A03/MF A01 CSCL 17/7

This is the eighteenth Discrete Address Beacon System Quarterly Technical Summary covering the period 1 April through 30 June 1976. Included are the results to date of analytical studies, laboratory and flight experiments, and software developments supporting the concept feasibility and performance definition phase of the FAA DABS Program. Author

N77-14001# National Aviation Facilities Experimental Center, Atlantic City, N.J

TEST AND EVALUATION OF SIX WIRE-WOUND TACTICAL AIR NAVIGATION AID (TACAN) HEATED RADOMES WITH WEATHER SENSORS Interim Report, Oct. 1974 - Apr. 1975

Harold Postel Aug. 1976 48 p

(FAA Proj. 042-306-000)

(AD-A030336/2; FAA-NA-75-67; FAA-RD-76-130) Avail: NTIS HC A03/MF A01 CSCL 17/7

Six wire-wound tactical air navigation aid (TACAN) heated radomes and weather-sensing systems installed on very high frequency omnirange/TACAN stations (VORTAC's) at (1) Mullan Pass, Idaho, (2) Lakeview, Oregon, (3) Elko, Nevada, (4) Denver, Colorado, (5) Rochester, Minnesota, and (6) Clarion, Pennsylvania were field evaluated. Their effectiveness was determined in preventing weather effects due to snow and/or ice accumulation at these six selected VORTAC facilities. Analysis of the data which were collected during the 6 months of testing indicated that the wire-wound radome, when modified with improved control stabilization circuit and adjusted for optimum operation, was effective in minimizing the accumulation of ice and/or snow on the vertical surface of the radome. Several modifications were developed to reduce or prevent excessive hunting by the various control circuitry. Author

N77-14002# Federal Aviation Administration, Washington, D.C.

A COMPARISON OF AIR RADIONAVIGATION SYSTEMS (FOR HELICOPTERS IN OFF-SHORE AREAS) Final Report

George H. Quinn Aug. 1976 20 p

(AD-A030337/0; FAA-RD-76-146) Avail: NTIS HC A02/MF A01 CSCL 17/7

The technical potential of ten navigation systems that may meet specific IFR en route navigation requirements for helicopters operating in off-shore areas is examined. Technical factors considered essential for navigation are: (1) operational range, (2) operational altitude, (3) accuracy, and (4) reliability. Estimated user equipment cost was included because of its importance in system selection. Author

N77-14003# Facility Checking Squadron (1866th) (AFCS), Richards-Gebaur AFB, Mo.

TRACALS EVALUATION REPORT. GROUND/AIR/GROUND COMMUNICATIONS SPECIAL EVALUATION REPORT, SHEPPARD AFB, TEXAS Final Report

Bruce E. Wallachy 24 May 1976 100 p ref

(AD-A026823; Rept-76/66S/59) Avail: NTIS HC A05/MF A01 CSCL 17/7

The purpose of the evaluation was to determine the reasons for and resolve complaints against the ATC communications system. This report summarizes and recommends solutions to problems concerning airfield blind spots, frequency accuracy of receiver equipment, RSU receiver frequency drift, intermittent communications in T-37 training areas, signal generator test equipment, noise interference in VHF frequency spectrum, and AN/GRR-25 versus AN/GRR-24 performance. Other information included specifies coverage data, and equipment performance. The results and tests presented in this report can be used with similar equipment and systems. GRA

N77-14004# Federal Aviation Administration, Washington, D.C. Air Traffic Service.

PERFORMANCE MEASUREMENT SYSTEM FOR MAJOR AIRPORTS Final Report

Bobby J. Woods and Allan R. Tobiason Nov. 1975 263 p refs

(AD-A026224) Avail: NTIS HC A12/MF A01 CSCL 17/7

This document summarizes the findings and implemented version of the Air Traffic Control Performance Measurement System (PMS) for major airports. Airports covered are Atlanta Hartsfield, Boston Logan, Cleveland Hopkins, Washington National, Denver Stapleton, Dallas Fort Worth Regional, Newark International, John F. Kennedy International, Los Angeles International, LaGuardia, Miami International, O'Hare International, Philadelphia International, Pittsburgh Greater, San Francisco International and St. Louis Lambert. PMS uses as its standard of measure a quantitatively derived version of airport capacity termed an Engineered Performance Standard (EPS).

Author (GRA)

N77-14005# Rome Air Development Center, Griffiss AFB, N.Y.

SECOND DOD WORKSHOP ON MILLIMETER WAVE TERMINAL GUIDANCE SYSTEMS: ADVERSE WEATHER EFFECTS

Edward E. Altshuler and David B. Ebeoglu May 1976 18 p refs Conf. Proc. held at Hanscom Field, Mass., 28 Jan. 1976

(AF Proj. 8682)

(AD-A026270; RADC-TM-76-9) Avail: NTIS HC A02/MF A01 CSCL 17/7

The objective of the workshop was to extend the level of understanding of the adverse weather problem within the DOD, so that millimeter-wave systems can be designed and tested effectively. The key frequencies of interest are 35 and 95 GHz. These papers review measurements, described measurement techniques, and reviewed and recommended instrumentation. It was concluded that a broad program of controlled experiments to measure the effects that precipitation and wet background would have on system performance should be conducted. In addition it was recommended that flight tests of millimeter wave

systems under actual adverse weather conditions be carried out. GRA

N77-14006# Mitre Corp., McLean, Va.
MULTI-SITE INTERMITTENT POSITIVE CONTROL ALGORITHMS FOR THE DISCRETE ADDRESS BEACON SYSTEM, REVISION 2
A. L. McFarland, K. R. Patel, and D. L. Roberts May 1976 241 p refs Revised
(Contract DOT-FA70WA-2448)
(AD-A026515; MTR-6742-CH-2; FAA-EM-74-4-Ch-2) Avail: NTIS HC A11/MF A01

This document presents complete detailed computer algorithms for implementing Intermittent Positive Control (IPC) within a multi-site Discrete Address Beacon System (DABS) network. This document is to be used by the Federal Aviation Administration to specify the IPC system which is to be provided as an integral part of the DABS Phase 2 system by the DABS System Development Contractor. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-14007*# McDonnell Aircraft Co., St. Louis, Mo.
SIMULATION TEST RESULTS FOR LIFT/CRUISE FAN RESEARCH AND TECHNOLOGY AIRCRAFT
Michael P. Bland and Roman K. Konsewicz 6 Dec. 1976 132 p refs
(Contract NAS2-9144)
(NASA-CR-137979; MDC-A4439) Avail: NTIS HC A07/MF A01 CSCL 01C

A flight simulation program was conducted on the flight simulator for advanced aircraft (FSAA). The flight simulation was a part of a contracted effort to provide a lift/cruise fan V/STOL aircraft mathematical model for flight simulation. The simulated aircraft is a configuration of the Lift/Cruise Fan V/STOL research technology aircraft (RTA). The aircraft was powered by three gas generators driving three fans. One lift fan was installed in the nose of the aircraft, and two lift/cruise fans at the wing root. The thrust of these fans was modulated to provide pitch and roll control, and vectored to provide yaw, side force control, and longitudinal translation. Two versions of the RTA were defined. One was powered by the GE J97/LF460 propulsion system which was gas-coupled for power transfer between fans for control. The other version was powered by DDA XT701 gas generators driving 62 inch variable pitch fans. The flight control system in both versions of the RTA was the same. Author

N77-14008# Dayton Univ., Ohio. School of Engineering.
LANDING GEAR/SOIL INTERACTION DEVELOPMENT OF CRITERIA FOR AIRCRAFT OPERATION ON SOIL DURING TURNING AND MULTIPASS OPERATIONS Final Report, 1 Jan. 1974 - 15 May 1975
David C. Kraft and Norman S. Phillips Wright-Patterson AFB, Ohio AFFDL Oct. 1975 175 p refs
(Contract F33615-73-C-3023; AF Proj. 1369)
(AD-A027422; AFFDL-TR-75-78) Avail: NTIS HC A08/MF A01 CSCL 08/13

The continuing design and operational requirements for military aircraft to operate on unimproved runways has led to the need to investigate those landing gear/soil runway parameters which most significantly influence performance. This report summarized those activities accomplished during the second year of a two-year research effort concerned with the development of criteria for turning, operation at high speed, and multipass operation. The work reported was conducted in several areas. The turned tire test data was completely analyzed and predictive equations incorporated into the turning program. A limited parametric study was conducted for three classes of vehicles to calculate wheel force ratios as functions of runway width required. A multipass test program was conducted at the Army Engineers Waterways Experiment Station to measure the response of rolling and braked tires in alternating paths. The data was reduced and predictive equations evolved from rut depths as a function of first pass response and subsequent path and braking. Limited start-up force data were examined to determine a preliminary estimate of start-up drag ratios. A soft tire/soil computer program was developed to study roughness effects. GRA

N77-14009# TRW Defense and Space Systems Group, Redondo Beach Calif.
COLLOID ADVANCED DEVELOPMENT PROGRAM Final Report, 1 Jun. 1972 - 2 Jan. 1976
S. Zafran Jun. 1976 631 p refs
(Contract F33615-70-C-1694)
(AD-A026723; AFRPL-TR-76-19) Avail: NTIS HC A99/MF A01 CSCL 01/3

This report is a technical summary of the system development phase of the Colloid Advanced Development Program. The program objective was to flight-qualify and radiation-harden a high performance colloid thruster system. Two prototype systems were developed. One operated in a constant current control mode, the other in a constant power, constant mass flow control mode. At start-of-life, the thruster produced 1-millipound thrust and greater than 1,350 seconds specific impulse for 70 watts of input power to the propulsion system. The propulsion system included a 432-needle array thruster, thermionic tungsten filament wire neutralizer, propellant storage and feed system, and a power conditioning and control system. GRA

N77-14010# TRW Defense and Space Systems Group, Redondo Beach Calif.
COLLOID ADVANCED DEVELOPMENT PROGRAM. APPENDIXES Final Report, 1 Jun. 1972 - 2 Jan. 1976
S. Zafran Jun. 1976 282 p refs
(Contract F33615-70-C-1694)
(AD-A026724; AFRPL-TR-76-19-App) Avail: NTIS HC A13/MF A01 CSCL 01/3

Two types of propellant storage tanks were developed. One was a self-pressurizing welded bellows, and the other was a spring assisted hydroformed bellows. Satisfactory system integration in both control modes was demonstrated through thrust stand, vacuum environment testing of the propulsion system during turn on, turn off, and steady-state thrust regulation. Life tests of 36-needle array thruster modules lasting over 4,000 and 5,000 hours provided measurements of long term performance change with time. Performance projections for a 10,000 hour mission based on life test data and thruster performance mapping after 2,500 hours of operation indicated an average specific impulse of 1,224 seconds for the mission. In addition to performance testing, system integration activities included thruster effluent compatibility, thermal characteristics, control loop dynamic response, and nuclear survivability studies. An electron beam-deflection electric field meter transducer was tested with breadboard electronics in anticipation of its use to evaluate propulsion system neutralizer effectiveness at geosynchronous altitude by determining the potential of the spacecraft with respect to its ambient plasma with the thruster on and off. GRA

N77-14011# Sikorsky Aircraft, Stratford, Conn.
INVESTIGATION OF ADVANCED HELICOPTER STRUCTURAL DESIGNS. VOLUME 1: ADVANCED STRUCTURAL COMPONENT DESIGN CONCEPTS STUDY Final Report
Melvin J. Rich May 1976 193 p refs
(Contract DAAJ02-74-C-0061; DA Proj. 1F2-62208-AH-90)
(AD-A026246; SER-50929-Vol-1;
USAAMRDL-TR-75-59A-Vol-1) Avail: NTIS HC A09/MF A01

Design studies have shown that weight and cost of a medium-size utility helicopter can be reduced through application of advanced concepts and materials. A baseline helicopter of conventional design was compared with designs employing advanced concepts and materials for the same gross weight. Results showed that weight empty (less engines, avionics, contingency) was reduced 12%, cost was reduced 3%, and payload was increased 70% (960 to 1,634 pounds). By incorporating the advanced concepts and materials into the initial design for the same payload, even greater reductions were found in weight and cost. Gross weight was reduced 14%, weight empty (less engines, avionics, contingency) 21%, and weight empty costs

14%. A risk and feasibility assessment was made for the airframe and landing gear, rotor and control system, and transmission structures. The airframe and landing gear were found to be of medium risk and feasibility. Rotor and control system risk is low, and feasibility is high. The transmission structures have medium risk and high feasibility. GRA

N77-14012# Sikorsky Aircraft, Stratford, Conn.
INVESTIGATION OF ADVANCED HELICOPTER STRUCTURAL DESIGNS: VOLUME 2: FREE PLANETARY TRANSMISSION DRIVE Final Report, 20 Jan. - 20 Jul. 1975
A. Korzun May 1976 100 p refs
(Contract DAAJ02-74-C-0061; DA Proj. 1F2-62208-AH-90)
(AD-A026247; SER-50932-Vol-2;
USAAMRDL-TR-75-59B-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 01/3

This volume investigates the free planetary transmission as applied to a utility transport helicopter. High-power rotary speed reduction gearing in helicopter transmissions usually takes the form of conventional epicyclic planetary reduction units. Research and development has led to development of the free planet transmission concept. This type of drive, compared with conventional two-stage planetary transmissions, promises several advantages, including 10% lighter weight, 16.5% lower cost in 500-unit quantities, 1/2 percent greater efficiency, almost twice the reliability, and greater tolerance to loss of lubrication. GRA

N77-14013# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
A CONTROL SYSTEM FOR THE WIND TUNNEL MODEL OF A REVERSE-BLOWING CIRCULATION CONTROL ROTOR (RB-CCR)
Kenneth R. Reader May 1976 39 p refs
(AD-A026548; DTNSRDC/ASED-1215) Avail: NTIS HC A03/MF A01 CSCL 01/3

A pneumatic valving system has been developed to provide cyclic and collective control inputs for a circulation control type rotor over an advance ratio range of 0 to 2.0. The design method and experimental techniques utilized in developing the control system for a wind tunnel model of the reverse-blowing circulation control rotor (RB-CCR) are discussed and a tradeoff is presented between two control systems which have potential for the necessary requirements. A cam-collector nozzle system is considered a better choice for the model rotor configuration than a cam-collector ring control system. It was concluded that a system to control the RB-CCR wind tunnel model can be designed by employing the proper area relationships and adhering to a simple design procedure. Author (GRA)

N77-14014# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.
AH-1 HELICOPTER VIBRATION LEVELS FOR STUB WING MOUNTED EQUIPMENT
Gordon D. Welford and Joseph S. Boland, III Sep. 1975 148 p
(AD-A026825; RG-76-30) Avail: NTIS HC A07/MF A01 CSCL 01/3

This report presents measured translational and angular acceleration inputs to stub wing mounted equipment on the AH-1 helicopter. In this case the wing mounted electro-optical systems were the stabilized platform airborne laser system and the stabilized mirror airborne laser system. The data are presented in the form of power spectral density, amplitude versus frequency, and oscillograph charts. GRA

N77-14015# Naval Intelligence Support Center, Washington, D.C. Translation Div.
AB 212 ASW: NEW MULTIPURPOSE HELICOPTER FOR ITALIAN NAVY
22 Jun. 1976 9 p Transl. into ENGLISH from Riv. Marittima, (Italy), Mar. 1976 p 140-144
(AD-A026861; NISC-Trans-3815) Avail: NTIS HC A02/MF A01 CSCL 01/3

The AB 212 ASW is a four-seat, all-weather, single-rotor and twin-turbine naval aircraft entirely made of metal. Specifications are as follows: length-17.39 m; width-2.85 m; rotor diameter-14.63 m; height (with rotor stopped)-4.01 m; and empty weight-3,420 kg. GRA

N77-14016# Naval Postgraduate School, Monterey, Calif.
A STUDY OF THE FAILURE OF JOINTS IN COMPOSITE MATERIAL FUEL CELLS DUE TO HYDRAULIC RAM LOADING M.S. Thesis
Henry Speer Ezzard, Jr. Jun. 1976 81 p refs
(AD-A027258) HC A05/MF A01 CSCL 01/3

The objectives of this research were to show the relative importance of the transverse shearing forces, the bending moments, and the tensile forces produced by hydraulic ram loading on military aircraft fuel tank joint designs for composite materials, and to present fuel tank test section designs. With the use of a finite element analysis, it was shown that the transverse shearing force may be major cause of attachment failure of composites, primarily by an unzipping or pull out mode of failure. It was also shown that failure criteria for transverse shearing stresses in composites are lacking. By comparing several specific aircraft design concepts, designs for a wing fuel test tank and a fuselage fuel test tank were selected. Simplicity, similarity to actual aircraft fuel tanks, and uniformity between experiments were primary considerations in the selection. Author (GRA)

N77-14017# Army Material Systems Analysis Activity, Aberdeen Proving Ground, Md.
DESIGN COMPARISON BETWEEN HELICOPTER AND TILT ROTOR AIRCRAFT
R. R. Oehrli Feb. 1976 43 p refs
(DA Proj. 1R7-65706-M-541)
(AD-A027559; AMSAA-TR-153) Avail: NTIS HC A03/MF A01 CSCL 01/3

A version of the AMSAA helicopter design program has been modified to include a tilt rotor analysis. This modification includes addition of a rotor strip theory performance analysis in the rigid mode. A series of studies have recently been completed with this analysis and this note has been prepared as a record of the procedures used. A discussion of the analysis and some example problems are shown. These indicate the size trade offs that are required to obtain the high speed advantage of a typical tilt rotor compared to a helicopter. Author (GRA)

N77-14018# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
STRUCTURAL STUDIES OF OBLIQUE FOLDING WINGS
R. M. Rivello Apr. 1976 65 p refs
(Contract N00017-72-C-4401)
(AD-A025712; APL/JHU/TG-1296) Avail: NTIS HC A04/MF A01 CSCL 16/4

Design studies on an oblique folding wing for a 34-in.-diameter, subsonic, cruise-type missile are described. Aeroelastic divergence and load amplification are investigated. It is found that divergence is not a problem, but load buildup on the forward-swept wing and load reduction on the aft-swept wing result in large rolling moments. Design studies of the wing pivot indicate that a Conrad four-point bearing and a torsion-spring actuator should result in a lightweight, reliable, and inexpensive fold mechanism. Weights and volumes of the oblique wing design are computed and compared with results of previous studies of swing-wing and wraparound-wing configurations. The wraparound wing is found to be the lightest and provides the greatest fuel volume. Author (GRA)

N77-13976# American Airlines, Inc., New York.
FUTURE AIRCRAFT REQUIREMENTS: A NOTEBOOK OF AIRLINE THOUGHTS
Richard J. Linn *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 1-29 Presented at College Park, Md. 17 Feb. 1976 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

N77-13979# Boeing Aerospace Co., Seattle, Wash.
AERODYNAMIC DESIGN
Ian H. Rettie *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 115-152 Presented at College Park, Md. 14 Oct. 1975 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

N77-13981# Douglas Aircraft Co., Inc., Santa Monica, Calif.
STRUCTURES AND MATERIALS
Melvin Stone *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 227-264 Presented at College Park, Md. 2 Dec. 1975 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

N77-13983# United Aircraft Corp., East Hartford, Conn.
ADVANCED HELICOPTER DESIGNS
Raymond F. Donovan *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 317-352 Presented at College Park, Md. 6 Apr. 1976 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N77-14019*# Sperry Flight Systems, Phoenix, Ariz.
STOLAND Final Report
John Grgurich and Peter Bradbury Nov. 1976 157 p refs
(Contract NAS2-6567)
(NASA-CR-137972) Avail: NTIS HC A04/MF A01 CSCL 01C

The STOLAND system includes air data, navigation, guidance, flight director (including a throttle flight director on the Augmentor Wing), 3-axis autopilot and autothrottle functions. The 3-axis autopilot and autothrottle control through parallel electric servos on both aircraft and on the augmentor wing, the system also interfaces with three electrohydraulic series actuators which drive the roll control surfaces, elevator and rudder. The system incorporates automatic configuration control of the flaps and nozzles on the augmentor wing and of the flaps on the Twin Otter. Interfaces are also provided to control the wing flap chokes on the Augmentor Wing and the spoilers on the Twin Otter. The STOLAND system has all the capabilities of a conventional integrated avionics system. Aircraft stabilization is provided in pitch, roll and yaw including control wheel steering in pitch and roll. The basic modes include altitude hold and select, indicated airspeed hold and select, flight path angle hold and select, and heading hold and select. The system can couple to TACAN and VOR/DME navaids for conventional radial flying. Author

N77-14020# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
MATRIX ELEMENT DISPLAY DEVICES AND THEIR APPLICATION TO AIRBORNE WEAPON SYSTEMS
Wayne L. Martin and Harry L. Task Jul. 1976 12 p refs
(AF Proj. 7184)
(AD-A027449; AMRL-TR-76-49) Avail: NTIS HC A02/MF A01 CSCL 09/5

A study was performed to determine the impact of two important matrix display design variables on tactical target recognition performance. Element density (i.e., the number of individual display resolution elements per degree as viewed by the observer) and the percent active area on the display surface were experimentally manipulated by adjusting the viewing distance from a rear projection screen over which a grid mask was placed. The targets were presented to subjects using zoom imagery at a simulated slant range which initially precluded recognition. As the target size increased, subjects were asked to press a remote projector control button when they were virtually certain of the correct response. The results indicate little effect of percent active area; i.e., down to 55 percent on target recognition performance for element angular subtense values between 0.75 and 3.0 minutes of arc (corresponding to element densities of from approximately 165 to 40 elements per inch at a 28 inch viewing distance). The effects of element density, however, were large and conformed to expectations derived from the limiting resolution of the visual system. Geometric mathematical derivations are provided for the relationships between element density, viewing distance, target size, sensor field of view, total number of display elements and slant range at time of target recognition. Author (GRA)

N77-14021# Naval Air Engineering Center, Lakehurst, N.J. Ground Support Equipment Dept.
DATA ITEM DESCRIPTION FOR ACQUISITION OF DETAILED PERFORMANCE CHARACTERISTICS AND SIGNAL TRACING DIAGRAMS FOR ELECTRONICS Final Report
T. McGrath 30 Apr. 1976 84 p refs
(AD-A026953; NAEC-GSED-Misc-0183-Rev-1-A) Avail: NTIS HC A05/MF A01 CSCL 14/2

The report describes how to record performance characteristics for Avionic UUT's (Units Under Test) in such a fashion that these characteristics can be computer manipulated. It also describes additional documentation required for the proper testing and fault isolation of UUT's. GRA

N77-14022# Westinghouse Electric Corp., Baltimore, Md.
MODULAR PACKAGING APPROACHES, VOLUME 1 Interim Report, 1 Jun. - 30 Nov. 1975
W. W. Staley Wright-Patterson AFB, Ohio AFAL Jun. 1976 103 p refs
(Contract F33615-75-C-1269)
(AD-A027520; AFAL-TR-76-61-Vol-1; Rept-75-1161-Vol-1)
Avail: NTIS HC A06/MF A01 CSCL 09/3

The objective of the study is to investigate the feasibility, practicality, and implementation of standard electronic modules (SEM) for avionics. Tradeoff studies are used to provide quantitative data to assist the Air Force Engineers in selecting the SEM format(s). The broad spectrum of considerations necessary to characterize standard packaging for a wide class of avionics applications are investigated. In depth quantification is placed primarily on digital signal processing and to a lesser degree on analog circuitry. The work is performed in three tasks whereby Task I evaluates current and past industry and DOD module programs, Task II studies present technology and technology trends for determination of the standard avionics module(s), and Task III is a compilation of industry and DOD data concerning standard module information and concepts. The report describes the details of the study with conclusions made and recommendations for future work to be considered. GRA

N77-14023# Defense Systems Management School, Fort Belvoir, Va.
ADVANCED AVIONICS FOR THE A-10: A DECISION ANALYSIS MODEL
Jackson A. Thomas May 1975 49 p refs
(AD-A027678) Avail: NTIS HC A03/MF A01 CSCL 09/3

Using decision analysis techniques a generic decision model for potential avionics enhancements to the A-10 aircraft is developed. Five generic avionics additions and the baseline single seat aircraft are considered in the decision model. Aspects of systems acquisition and the impact of war are also incorporated. The model developed provides the basis for a flexible management tool that can assist the program manager in reaching a decision, if one should be required, concerning avionics additions to the A-10 aircraft. The model demonstrates how the decision analysis techniques can be applied to an unstructured decision problem encountered in program management. Author (GRA)

N77-14024# Illinois Univ., Urbana-Champaign. Aviation Research Lab.
A VERSATILE COMPUTER-GENERATED DYNAMIC FLIGHT DISPLAY
Bruce Arthur Artwick May 1976 78 p refs
(Contract N00014-76-C-0081; NR Proj. 196-133)
(AD-A027419; ARL-76-5/ONR-76-1) Avail: NTIS HC A05/MF A01 CSCL 01/4

This report describes a real-time, dynamic, computer-driven visual display program which is written in the FORTRAN programming language. Versatility, efficiency and ease of use are stressed in the development, resulting in an easy to interface to dynamic display which can be implemented economically with a bare minimum of graphics hardware and a sixteen bit mini-computer which has FORTRAN capabilities. Modular structure is stressed and speedup methods are discussed including the use of a matrix multiplier. A unique frame synthesizing feature is described in detail. Sample data base structures and display images conclude the report. Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N77-14025* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DUAL OUTPUT VARIABLE PITCH TURBOFAN ACTUATION SYSTEM Patent

Robert H. Griswold, Jr. (GE, Cincinnati) and Carl L. Broman, inventors (to NASA) (GE, Cincinnati) Issued 30 Nov. 1976 10 p Filed 21 May 1975 Sponsored by NASA

(NASA-Case-LEW-12419-1; US-Patent-3,994,128; US-Patent-Appl-SN-579375; US-Patent-Class-60-226R; US-Patent-Class-416-160; US-Patent-Class-416-162; US-Patent-Class-416-165; US-Patent-Class-416-167; US-Patent-Class-416-153) Avail: US Patent Office CSCL 21E

An improved actuating mechanism was provided for a gas turbine engine incorporating fan blades of the variable pitch variety, the actuator adapted to rotate the individual fan blades within apertures in an associated fan disc. The actuator included means such as a pair of synchronizing ring gears, one on each side of the blade shanks, and adapted to engage pinions disposed thereon. Means were provided to impart rotation to the ring gears in opposite directions to effect rotation of the blade shanks in response to a predetermined input signal. In the event of system failure, a run-away actuator was prevented by an improved braking device which arrests the mechanism.

Official Gazette of the U.S. Patent Office

N77-14026*# United Technologies Corp., East Hartford, Conn.

COST/BENEFIT ANALYSIS OF ADVANCED MATERIALS TECHNOLOGIES FOR FUTURE AIRCRAFT TURBINE ENGINES

J. W. Bisset Nov. 1976 38 p refs

(Contract NAS3-20072; et al)

(NASA-CR-135107; PWA-5453) Avail: NTIS HC A03/MF A01 CSCL 21E

The cost/benefits of advance commercial gas turbine materials are described. Development costs, estimated payoffs and probabilities of success are discussed. The materials technologies investigated are: (1) single crystal turbine blades, (2) high strength hot isostatic pressed turbine disk, (3) advanced oxide dispersion strengthened burner liner, (4) bore entry cooled hot isostatic pressed turbine disk, (5) turbine blade tip - outer airseal system, and (6) advance turbine blade alloys. M.C.F.

N77-14027*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FURTHER STUDIES OF STATIC TO FLIGHT EFFECTS ON FAN TONE NOISE USING INLET DISTORTION CONTROL FOR SOURCE IDENTIFICATION

Brent K. Hodder Dec. 1976 42 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.

(NASA-TM-X-73183; A-6821) Avail: NTIS HC A03/MF A01 CSCL 20A

Current experimental investigations have linked static inflow distortion phenomena such as the ground vortex, atmospheric turbulence, and teststand structure interference to the generation of fan tone noise at the blade passing frequency. Since such distortions do not exist in flight, it is important to remove them from the static test environment and thereby improve the static-to-flight tone-noise correlation. In the course of providing evidence for this position, a recent investigation used a distortion control inlet with a modern day turbofan engine to assess atmospheric turbulence effects. Although the initial results were encouraging, they were incomplete. The present investigation continues this work and shows more completely the effect of atmospheric turbulence on tone-noise generation. Further, use is made of the distortion control inlet to identify other competing tone-noise sources in the test engine such as a rotor-core stator interaction which was confirmed by engine modifications. Author

N77-14028# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.

CORE ENGINE NOISE PROGRAM. VOLUME 3: PREDICTION METHODS. SUPPLEMENT 1: EXTENSION OF PREDICTION METHODS Final Report, Jun. 1974 - May 1975

J. J. Emmerling, S. B. Kazin, and R. K. Matta Mar. 1976 51 p refs

(Contract DOT-FA72WA-3023)

(AD-A030376/8; R76AEG305; FAA-RD-74-125-Vol-3-Suppl-1) Avail: NTIS HC A04/MF A01 CSCL 21/5

The core noise prediction technique described was validated using several additional sets of engine data. The data included discernible core noise at high power settings and were derived from both General Electric and external tests, on engines by GE and other manufacturers. The three line power level prediction method was collapsed to single unified line prediction through addition of a turbine work extraction term to account for the low frequency noise attenuation due to turbine blading. Data from combustor component tests were compared to engine noise levels and found to indicate significant attenuation of low frequency noise in propagation through turbine stages. An analytical method for predicting this low frequency noise attenuation is provided.

Author

N77-14029*# Boeing Commercial Airplane Co., Seattle, Wash. Dept. of Preliminary Design.

ENERGY CONSUMPTION CHARACTERISTICS OF TRANSPORTS USING THE PROP-FAN CONCEPT Final Report

Oct. 1976 147 p refs

(Contract NAS2-9104)

(NASA-CR-137937; D6-75780) Avail: NTIS HC A07/MF A01 CSCL 01C

The fuel saving and economic potentials of the prop-fan high-speed propeller concept were evaluated for twin-engine commercial transport airplanes designed for 3333.6 km range, 180 passengers, and Mach 0.8 cruise. A fuel saving of 9.7% at the design range was estimated for a prop-fan airplane having wing-mounted engines, while a 5.8% saving was estimated for a design having the engines mounted on the aft body. The fuel savings and cost were found to be sensitive to the propeller noise level and to aerodynamic drag effects due to wing-slipstream interaction. Uncertainties in these effects could change the fuel savings as much as + or - 50%. A modest improvement in direct operating cost (DOC) was estimated for the wing-mounted prop-fan at current fuel prices. This improvement could become substantial in the event of further relative increases in the price of oil. The improvement in DOC requires the achievement of the nominal fuel saving and reductions in propeller and gearbox maintenance costs relative to current experience. Author

N77-14030*# Boeing Commercial Airplane Co., Seattle, Wash. Dept. of Preliminary Design.

ENERGY CONSUMPTION CHARACTERISTICS OF TRANSPORTS USING THE PROP-FAN CONCEPT: SUMMARY REPORT Final Report

Nov. 1976 50 p refs

(Contract NAS2-9104)

(NASA-CR-137938; D6-75780) Avail: NTIS HC A03/MF A01 CSCL 01C

For abstract, see N77-14029.

N77-14031*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SMALL, LOW COST, EXPENDABLE TURBOJET ENGINE. 2: PERFORMANCE CHARACTERISTICS

Robert P. Dengler and Lawrence E. Macioce Washington Dec. 1976 31 p refs

(NASA-TM-X-3463; E-8775) Avail: NTIS HC A03/MF A01 CSCL 21E

A small experimental axial-flow turbojet engine was tested at sea level static conditions and over a range of simulated flight conditions to evaluate its performance as well as to demonstrate the feasibility of low-cost concepts utilized in its design. Testing was conducted at engine speeds as high as

37,000 rpm and at turbine inlet temperatures as high as 1,272 K. For maximum speed the engine produced a net thrust of 3,118 newtons at sea level static operation and 2,318 newtons at its cruise condition of MO = 0.8 and 6,096 meters. Data obtained over a range of inlet Reynolds number indexes for nominal MO of 0.38 revealed similar effects or trends on compressor characteristics of those previously established for much larger engines. Author

N77-14032*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF EXHAUST GAS RECIRCULATION ON EMISSIONS FROM A FLAME-TUBE COMBUSTOR USING LIQUID JET A FUEL
Cecil J. Marek and Robert R. Tacina Washington Dec. 1976 26 p refs
(NASA-TM-X-3464; E-8803) Avail: NTIS HC A03/MF A01 CSCL 21E

The effects of uncooled exhaust gas recirculation as an inert diluent on emissions of oxides of nitrogen (NO + NO2) and on combustion efficiency were investigated. Ratios of recirculated combustion products to inlet airflow were varied from 10 to 80 percent by using an inlet air ejector nozzle. Liquid Jet A fuel was used. The flame-tube combustor was 10.2 cm in diameter. It was operated with and without a flameholder present. The combustor pressure was maintained constant at 0.5 MPa. The equivalence ratio was varied from 0.3 to 1.0. The inlet air temperature was varied from 590 to 800 K, and the reference velocity from 10 to 30 m/sec. Increasing the percent recirculation from 10 to 25 had the following effects: (1) the peak NOx emission was decreased by 37 percent, from 8 to 5 g NO2/kg fuel, at an inlet air temperature of 590 K and a reference velocity of 15 m/sec; (2) the combustion efficiency was increased, particularly at the higher equivalence ratios; and (3) for a high combustion efficiency of greater than 99.5 percent, the range of operation of the combustor was nearly doubled in terms of equivalence ratio. Increasing the recirculation from 25 to 50 percent did not change the emissions significantly. Author

N77-13980# Pratt and Whitney Aircraft, East Hartford, Conn. Engineering Dept.
AIR TRANSPORT PROPULSION FOR THE 1980'S
J. W. Witherspoon *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 153-225 Presented at College Park, Md. 11 Nov. 1975 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N77-14033*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PILOT-MODEL MEASUREMENTS OF PILOT RESPONSES IN A LATERAL-DIRECTIONAL CONTROL TASK
James J. Adams Washington Dec. 1976 23 p refs
(NASA-TN-D-8357; L-11057) Avail: NTIS HC A02/MF A01 CSCL 05E

Pilot response during an aircraft bank-angle compensatory control task was measured by using an adaptive modeling technique. In the main control loop, which is the bank angle to aileron command loop, the pilot response was the same as that measured previously in single-input, single-output systems. The pilot used a rudder to aileron control coordination that canceled up to 80 percent of the vehicle yawing moment due to aileron deflection. Author

N77-14034# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
REALIZATION OF A VOTER/MONITOR FOR A DIGITAL FLIGHT CONTROL SYSTEM M. S. Thesis. Final Report
Jesse E. Bush Jun. 1976 146 p refs
(AD-A027434; GE/EE/76J-7) Avail: NTIS HC A07/MF A01 CSCL 01/3

A software Voter/Monitor (V/M) system is designed and implemented. The V/M is an informational processing device which is to be used in a digital flight control system (DFCS). A DFCS is currently being developed to replace existing analogue flight control systems in selective military aircrafts. The V/M receives data over four separate input channels, and it performs a processing routine which (a) allows it to continually select one of the input channel data for routing over its single output channel; and (b) allows it to maintain a history of each input channel data for routing over its single output channel; and (c) allows it to maintain a history of each input channel performance and declare as defective any input channel from which it consistently receives 'bad' data. The V/M is implemented using the National Semiconductor IMP-16L Microcomputer. The V/M processing scheme uses input-input comparison monitoring. Software coding and hardware circuitry are designed. Additionally, a software test program is constructed. The V/M system testing is limited. The correct performance of the V/M system is illustrated under a static testing environment. GRA

N77-14035# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ANALYSIS OF INHERENT ERRORS IN ASYNCHRONOUS REDUNDANT DIGITAL FLIGHT CONTROL SYSTEMS Final Report, 9 Jun. - 31 Oct. 1975
Vincent J. Darcy and Charles R. Slivinsky Apr. 1976 154 p refs
(AF Proj. 2049)
(AD-A026954; AFFDL-TR-76-16) Avail: NTIS HC A08/MF A01 CSCL 01/4

The concept of skewed sampling is developed and a single-rate, closed-loop state variable model for realistic aircraft control loops is developed. Using this model, a covariance analysis of the channel differences is given. This statistical treatment is based on filtered white noise external inputs, but it is shown how such inputs can be used to generate signals which approximate the true system external inputs. The model and the analysis are general and applicable to a variety of systems. A user-oriented software package, using FORTRAN, is developed to facilitate the required computations and to allow parametric studies of the effect on inherent errors of control system gains, time constants, sample time and other parameters. The analysis is applied to several examples, including time and other parameters. The analysis is applied to several examples, including a study of inherent errors in an asynchronous dual-redundant digital version of the A-7D pitch-axis control augmentation system. GRA

N77-13982# Lockheed-Georgia Co., Marietta.
EFFECTS OF ARTIFICIAL STABILITY ON CONFIGURATION DESIGN
Roy H. Lange *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 265-315 refs Presented at College Park, Md. 23 Mar., 1976 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N77-14036# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION AND RECOMMENDATIONS FOR SNOW-DRIFT CONTROL AT FAA ILS FACILITIES, BARROW AND DEADHORSE, ALASKA Final Report
Darryl J. Calkins Sep. 1976 41 p refs
(Contract DOT-FA76NA-AP-1)
(AD-A030401/4; FAA-NA-76-165; FAA-RD-76-139) Avail: NTIS HC A03/MF A01 CSCL 01/5

The existing snowdrifting conditions are described at the Barrow and Deadhorse airfields and makes recommendations for minimizing the drifting snow at the ILS facilities. The problem of drifting snow at the localizer and glide slope facilities was a result of the structures themselves creating drifts and causing outages. The most economical method of eliminating the problem at the glide slope was relocation of the instrument shelters such that they are not in line with the antenna masts and the prevailing wind direction. The localizer snowdrifts were caused by the bulkiness of the supporting structure carrying the antenna; although it is elevated on piles severe turbulence develops behind the structure and the snow deposits. Wooden snowfences, 10 ft high, in the parallel rows 200 ft apart will control the snow during an average snow year. Model studies of each alternative method were carried out to validate the various proposals. Author

N77-14037*# McDonnell Aircraft Co., St. Louis, Mo.
MATHEMATICAL MODEL FOR LIFT/CRUISE FAN V/STOL AIRCRAFT SIMULATOR PROGRAMMING DATA
M. P. Bland, B. Fajfar, and R. K. Konsewicz 6 Dec. 1976 263 p
(Contract NAS2-9144)
(NASA-CR-151916; MDC-A4571) Avail: NTIS HC A12/MF A01 CSCL 14B

Simulation data are reported for the purpose of programming the flight simulator for advanced aircraft for tests of the lift/cruise fan V/STOL Research Technology Aircraft. These simulation tests are to provide insight into problem areas which are encountered in operational use of the aircraft. A mathematical model is defined in sufficient detail to represent all the necessary pertinent aircraft and system characteristics. The model includes the capability to simulate two basic versions of an aircraft propulsion system: (1) the gas coupled configuration which uses insulated air ducts to transmit power between gas generators and fans in the form of high energy engine exhaust and (2) the mechanically coupled power system which uses shafts, clutches, and gearboxes for power transmittal. Both configurations are modeled such that the simulation can include vertical as well as rolling takeoff and landing, hover, powered lift flight, aerodynamic flight, and the transition between powered lift and aerodynamic flight. Author

N77-14038*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A REMOTELY OPERATED MULTIPLE ARRAY ACOUSTIC RANGE (ROMAAR) AND ITS APPLICATION FOR THE MEASUREMENT OF AIRPLANE FLYOVER NOISE FOOTPRINTS
David A. Hilton and Herbert H. Henderson Nov. 1976 27 p Presented at 92d ASA Meeting, San Diego, Calif., 16-19 Nov. 1976
(NASA-TM-X-73986) Avail: NTIS HC A03/MF A01 CSCL 14B

The ROMAAR now in operation at NASA will allow direct measurement and display of aircraft noise in several measurement units during takeoff, landing, and flyby operations. This information, in addition to its application in terms of ground noise footprints, will also permit determination of the statistical variation of footprints or contours due to the atmosphere or aircraft operational parameters, and a measure of the impact of various noise reduction techniques and hardware on ground noise footprints. The methods, techniques, and equipment developed for the ROMAAR concept are applicable to CTOL, STOL, General Aviation, and VTOL aircraft. ROMAAR represents a unique combination of state of the art digital and analog noise recording methods, computer-controlled digital communications methods, radar-tracking facilities, quick-look weather capabilities, and a large data handling facility complemented by a large capacity curve fitting and plotting routine. The ROMAAR is set apart from the standard airport noise monitoring system by having the unique features mentioned above plus the fact that at present as many as 38 separate (but simultaneous) noise measurements can be made for each aircraft overflight. Author

N77-14039# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
AERONAUTICAL SYSTEMS TECHNOLOGY NEEDS. TEST FACILITIES AND TEST EQUIPMENT Annual Report, Jan. - Dec. 1976
Donald C. Kittinger Jun. 1976 24 p Supersedes ASD-TR-75-16
(AD-A026022; ASD-TR-76-13; ASD-TR-75-16) Avail: NTIS HC A02/MF A01 CSCL 15/5

This report is a part of a compilation of formalized Technology Needs (TN) covering Personnel Subsystems and Support Subsystems as identified by the Aeronautical Systems Division. They are based on development/operational experience, system studies and new concepts - all related to future system applications. Their presentation is to serve a threefold purpose: i.e., (1) guidance for technology program, (2) proven development potential, and (3) engineering data/requirements essential for technology use in systems. The identified needs delineate progress desired in performance, control, design flexibility, safety, and cost. Author (GRA)

N77-14040# Braddock, Dunn and McDonald, Inc., Vienna, Va.
OPERATIONAL TEST INSTRUMENTATION GUIDE. VOLUME 3: NON-ARMY DOD TEST FACILITIES
1 Mar. 1976 579 p refs Prepared jointly with RMC Research Corp., Bethesda, Md.
(Contract DAAG39-73-C-0130)
(AD-A026664) HC A25/MF A01 CSCL 14/2

The United States Army Operational Test and Evaluation Agency (OTEA) Instrumentation Guide presents, in three volumes, the results of an operational test-oriented survey of some thirty-three Department of Defense test/training facilities. In addition to the available instrumentation, detailed information is provided on the landspace, airspace, data reduction, and other general support capabilities of each installation. The general support area includes such information as: (a) type, location, size, and commitments of nearby military units; (b) facility access; (c) maintenance and logistics capability; (d) climate and topography; and (e) power/communications availability. Test support equipment mobility is addressed throughout the guide to indicate its flexibility for use. The Summary (volume I) presents an overview and provides an easy rapid determination of the general facility capabilities for operational tests of Army materiel as compared, in matrix form, with the other potential test facilities. The two succeeding volumes present detailed test support information for each facility. Volume II contains annexes addressing the capabilities of US Army facilities and Volume III presents information for the non-Army DOD facilities. General (unclassified) discussions of threat hardware and targets available at the test facility are presented. Other detailed information in this critical area was reported in Operational Test and Evaluation Simulation Guide, Volume III, Classified Simulator Devices (U), AD-C000 021 published in March 1974. Author (GRA)

N77-14041# Naval Training Equipment Center, Orlando, Fla.
DESIGN STUDY OF AN OPTICAL SYSTEM FOR PANORAMIC IMAGERY Final Report, Mar. 1972 - Mar. 1976
Gottfried R. Rosendahl, Wiley V. Dykes, and Frank J. Oharek Jun. 1976 63 p refs
(AD-A026281; NAVTRAEQUIPC-IH-254) Avail: NTIS HC A04/MF A01 CSCL 14/5

In meeting requirements for ever larger field angles in training devices, such as for helicopter pilots, tank drivers, etc., a design study of a lens system for panoramic imagery was made. Two designs have been brought to the point where their manufacture can commence: Design A with 50mm image diameter, F/5, elevation angles of -60 and -30 deg; Design B with 95mm image diameter, F/10, and elevation angles of -28 and -15 deg. The optical system consists of two (protected) confocal hyperboloidal mirrors acting as a reversed Gallilean telescope, followed by a refractive system. The system can be used as a camera and as projection lens; it has been designed to withstand the heat of a high power arc lamp. Resolution is about 40 lines/mm, but there is room for further improvements. GRA

N77-14042# Air Force Weapons Lab., Kirtland AFB, N.Mex.
A DESCRIPTION OF THE THERMAL DISTORTION TEST FACILITY AT THE AIR FORCE WEAPONS LABORATORY Final Report
A. B. Callender and Raymond H. Bloomer, Jr. May 1976 41 p
(AF Proj. 317J)

(AD-A027364; AFWL-TR-76-86) Avail: NTIS HC A03/MF A01 CSCL 20/6

The Thermal Distortion Test Facility at the Air Force Weapons Laboratory provides an in-house capability for obtaining interferometric measurements of laser produced thermal distortions in water-cooled mirrors of interest to the Air Force Advanced Radiation Technology program. A rastered electron beam is used to simulate the laser heating. The facility is currently testing mirrors up to 40 cm in diameter and with water flows of up to 45 GPM. Data in the form of 35-mm negatives and video tapes, are reduced to give distortion information with typically a precision of + or - 0.05 micrometer at absorbed power densities in excess of 1 kilowatt/sq cm. This report is a facility description designed in part to give the potential user a basic understanding of the system capabilities and the technical requirements which must be met to prepare for a test. Author (GRA)

N77-14043# Naval Surface Weapons Center, White Oak, Md.
STATIC MULTIPLE-LOAD MEASUREMENT TECHNIQUE AS UTILIZED IN THE NAVAL SURFACE WEAPONS CENTERS WIND TUNNELS
John E. Holmes 30 Apr. 1976 46 p refs
(AD-A027097; NSWC/WOL/TR-76-26) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report describes the basic scheme used in the Naval Surface Weapons Center's wind tunnels for measuring static forces and moments on wind-tunnel models. The general fundamentals used in the design of balances are explained as well as how the calibrations are conducted and how the data are reduced. The basic technique consists of using multiple combined loads in the calibration of the balance and in using an iterative approach to reduce the balance electrical output to aerodynamic loads. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N77-14044*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Sep. - Oct. 1976
15 Dec. 1976 163 p refs
(Contract NAS7-100)
(NASA-CR-149275; JPL-PR-42-36) Avail: NTIS HC A08/MF A01 CSCL 22D

Progress in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operations is reported. For individual titles, see N77-14045 through N77-14064.

N77-14045*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Dec. 1976 p 1-3 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized. Deep space station, ground communication, and network operations control capabilities are described. Author

N77-14046*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN GROUND COMMUNICATIONS FACILITY c14
M. S. Glenn *In its* The Deep Space Network 15 Dec. 1976 p 4-12 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The Ground Communications Facility (GCF) is one of the three functional elements of the Deep Space Network (DSN) and provides the capability required for the transmission, reception, and monitoring of voice and data communications between the various locations of the DSN. The GCF uses common carrier circuits interconnected to specialized switching, terminal, and monitor equipment, integrated into a world-wide system, and operated in support of space flight missions. The five subsystems of GCF (Teletype, Voice, High-Speed, Wideband, and Monitor) are described. The Office of Tracking and Data Acquisition of the Jet Propulsion Laboratory provides the technical direction and systems management of the GCF and acts as the representative of NASCOM for communications switching functions on the west coast. Author

N77-14047*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING MISSION SUPPORT c14
D. W. Johnston and T. Howe *In its* The Deep Space Network 15 Dec. 1976 p 13-21 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 22D

The most significant Viking Mission events supported by the DSN during August and September 1976 are reported. Intermediate Data production and DSS support are also summarized for this period. Viking DSN Discrepancy Report activity for the period January 1975 through September 1976 is also included. Author

N77-14048*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT c14
R. B. Miller *In its* The Deep Space Network 15 Dec. 1976 p 22-27 ref (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 22D

The Tracking and Data Acquisition portion of the Ground Data System, which will support the Differential Long Baseline Interferometry Wind Measurement Experiment, is described. Author

N77-14049*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT c14
P. S. Goodwin, E. S. Burke, and R. E. Morris *In its* The Deep Space Network 15 Dec. 1976 p 28-34 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 22D

The Helios-1 third solar occultation and fourth perihelion is covered. A Helios-2 spacecraft emergency and third solar conjunction (occultation) are also discussed. Additional topics include STDN-DSN telemetry and command cross-support, Ground Data System tests, tracking coverage, plus DSN system performance for August and September 1976. Author

N77-14050*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TERMINOLOGY OF RANGING MEASUREMENTS AND DSS CALIBRATIONS c17
T. Komarek and T. Otoshi *In its* The Deep Space Network 15 Dec. 1976 p 35-40 ref (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

A set of basic terminology related to deep space ranging measurements is proposed. Calibration equations are derived for the dish-mounted zero delay device method for 26-m antenna systems and the translator method for 64-m antenna systems. Author

N77-14051*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MAGNITUDE OF 64-m ELEVATION AXIS MOVEMENTS DUE TO ALIDADE TEMPERATURE CHANGES c32
N. T. Hung, H. Phillips, and R. Zanteson *In its* The Deep Space Network 15 Dec. 1976 p 41-44 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 17I

In projected very-long baseline interferometry (VLBI) work a reference point for 64-m antennas is the intersection of the elevation and azimuth axes. A minimum-level effort at DSS 14 to determine the magnitude of the effect of diurnal changes in the temperature of the alidade legs on the height of the elevation axis is described. The thermal expansion between the lowest recorded temperature -3 C (27 F) and the highest, 36 C (97 F), over the period covered was 8.9 mm (0.35 in.). Author

N77-14052*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN IMPROVED UPPER BOUND ON THE BLOCK CODING ERROR EXPONENT FOR BINARY INPUT DISCRETE MEMORYLESS CHANNELS c17
R. J. McEliece and J. K. Omura (Calif. Univ., Los Angeles) *In its* The Deep Space Network 15 Dec. 1976 p 45-48 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

For coded telemetry systems it is important to know the tradeoff between the error probability and the complexity of implementation. For systems using block codes, the block coding error exponent is a good way to estimate this tradeoff. The new upper bounds on the minimum distance of binary codes result in improved upper bounds on the coding error exponents for binary input memoryless channels. Author

N77-14053*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A RADAR STUDY OF THE BACKUP MARTIAN LANDING SITES **c91**
G. S. Downs, R. R. Green, and P. E. Reichley *In its* The Deep Space Network 15 Dec. 1976 p 49-52 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 03B

The Goldstone radar system at DSS 14 was used to probe the Martian surface at 8495 MHz in a narrow strip between -6 deg and -2 deg latitude. The Viking C landing sites lie in this strip, and their altitudes, rms surface slope, and reflectivity are presented. Author

N77-14054*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE EFFECT OF DIRECT CURRENT BIAS IN THE COMPUTATION OF POWER SPECTRA **c33**
E. R. Rodemich *In its* The Deep Space Network 15 Dec. 1976 p 53-57 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 09C

The effect of dc bias in the approximate computation of spectra of Gaussian processes is determined by hard limiting. Author

N77-14055*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STANDARD RANDOM NUMBER GENERATION FOR MBASIC **c61**
R. C. Tausworthe *In its* The Deep Space Network 15 Dec. 1976 p 58-62 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 09B

A machine-independent algorithm is presented and analyzed for generating pseudorandom numbers suitable for the standard MBASIC system. The algorithm used is the polynomial congruential or linear recurrence modulo 2 method. Numbers, formed as nonoverlapping adjacent 28-bit words taken from the bit stream produced by the formula a sub m + 532 = a sub m + 37 + a sub m (modulo 2), do not repeat within the projected age of the solar system, show no ensemble correlation, exhibit uniform distribution of adjacent numbers up to 19 dimensions, and do not deviate from random runs-up and runs-down behavior. Author

N77-14056*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE FAST DECODING OF REED-SOLOMON CODES USING FERMAT THEORETIC TRANSFORMS AND CONTINUED FRACTIONS **c61**
L. R. Welch (Univ. of Southern Calif.), I. S. Reed (Univ. of Southern Calif.), and T. K. Truong *In its* The Deep Space Network 15 Dec. 1976 p 63-74 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 09B

It is shown that Reed-Solomon (RS) codes can be decoded by using a fast Fourier transform algorithm over finite fields GF(F sub n) where F sub n is a Fermat prime, and continued fractions. This new transform decoding method is simpler than the standard method for RS codes. The computing time of this new decoding algorithm in software can be faster than the standard decoding method for RS codes. Author

N77-14057*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE FAST DECODING OF REED-SOLOMON CODES USING HIGH-RADIX FERMAT THEORETIC TRANSFORMS **c61**
K. Y. Liu (Univ. of Southern Calif.), I. S. Reed (Univ. of Southern Calif.), and T. K. Truong *In its* The Deep Space Network 15 Dec. 1976 p 75-80 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 09B

Fourier-like transforms over GF(F sub n), where F sub n = 2(2n) + 1 is a Fermat prime, are applied in decoding Reed-Solomon codes. It is shown that such transforms can be computed using high-radix fast Fourier transform (FFT) algorithms requiring considerably fewer multiplications than the more usual radix 2 FFT algorithm. A special 256-symbol, 16-symbol-error-correcting, Reed-Solomon (RS) code for space communication-link applications can be encoded and decoded using this high-radix FFT algorithm over GF(F sub 3). Author

N77-14058*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM PERFORMANCE WITH CONVOLUTIONALLY CODED DATA USING OPERATIONAL MAXIMUM-LIKELIHOOD CONVOLUTIONAL DECODERS **c17**
B. Benjauthrit, B. Mulhall, B. D. Madsen, and M. E. Alberda *In its* The Deep Space Network 15 Dec. 1976 p 81-101 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

The DSN telemetry system performance with convolutionally coded data using the operational maximum-likelihood convolutional decoder (MCD) being implemented in the Network is described. Data rates from 80 bps to 115.2 kbps and both S- and X-band receivers are reported. The results of both one- and two-way radio losses are included. Author

N77-14059*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MODIFICATION OF HIPOTRONICS DISCONTINUITY ENAMEL WIRE TEST FOR WIRE SCREENING **c38**
W. D. Schreiner *In its* The Deep Space Network 15 Dec. 1976 p 102-104 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 14D

The wire spindle section of the wire screening test equipment was redesigned to prevent breakage of small gage magnet wire during testing operations. Author

N77-14060*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TWO MBASIC PROGRAMS THAT WRITE APPLICATION PROGRAMS FOR ACCESSING A DATABASE **c61**
R. M. Smith *In its* The Deep Space Network 15 Dec. 1976 p 105-113 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 09B

A method was desired to relieve the tedium of writing and testing application programs. Two utility programs were developed to produce application programs that perform relational operations on data. No coding is performed by the user. Author

N77-14061*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIFFERENTIAL RANGE VALIDATION: A NEW TECHNIQUE FOR NEAR-REAL-TIME VALIDATION OF MULTISTATION RANGING SYSTEM DATA **c17**
A. L. Berman *In its* The Deep Space Network 15 Dec. 1976 p 114-120 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

Near-real-time validation of ranging system data is currently restricted to multiple range acquisitions during single passes (Pseudo-DRVID). A technique (Differential Range Validation) which utilizes predicted range and doppler pseudo-residuals to validate two-station, contiguous-pass range acquisitions down to the 10-meter level is described. Author

N77-14062*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE 1976 HELIOS AND PIONEER SOLAR CONJUNCTIONS-CONTINUING CORROBORATION OF THE LINK BETWEEN DOPPLER NOISE AND INTEGRATED SIGNAL PATH ELECTRON DENSITY **c92**
A. L. Berman, J. A. Wackley, and S. T. Rockwell *In its* The Deep Space Network 15 Dec. 1976 p 121-137 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 03B

Observed Doppler noise (rms phase jitter) from the 1976 solar conjunctions of the Helios 1 and 2 and the Pioneer 10 and 11 spacecraft was processed with a recently developed Doppler noise model ISEDB. Good agreement is obtained between the observed data and the model. Correlation is shown between deviations from the ISEDB model and sunspot activity, but it is insufficient to be modeled. Correlation is also shown between ISEDB model deviations for (spacecraft) signal paths on the same side of the sun. Author

N77-14063*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSS RANGE DELAY CALIBRATIONS: CURRENT PERFORMANCE LEVEL **c17**
G. L. Spradlin *In its* The Deep Space Network 15 Dec. 1976 p 138-152 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

A means for evaluating Deep Space Station (DSS) range delay calibration performance was developed. Inconsistencies frequently noted in these data are resolved. Development of the DSS range delay data base is described. The data base is presented with comments regarding apparent discontinuities. Data regarding the exciter frequency dependence of the delay values are presented. The improvement observed in the consistency of current DSS range delay calibration data over the performance previously observed is noted. Author

N77-14064*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN RESEARCH AND TECHNOLOGY SUPPORT **c14**
E. B. Jackson *In its* The Deep Space Network 15 Dec. 1976 p 153-156 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

Continuing remote controlled pulsar observations are noted, along with routine observations of 22 pulsars. Preliminary installation of equipment for planned unattended operation of the Venus Station is reported, along with extensive measurements and performance evaluation of the 26-m antenna. Support of the X-band radar at the Mars Station (DSS 14), and stability and reliability testing of the DSS 13 receiving system is reported. Klystron testing and other DSN support activities of the DSN High-Power Transmitter Maintenance Facility are noted, along with energy conservation modifications to two buildings at DSS 13. Radio Science experiment support included Planetary Radio Astronomy, Pulsar Rotation Constancy, Interstellar Microwave Spectroscopy, and Very Long Baseline Interferometry observations. An increased schedule of clock synchronization transmissions, planned on five-day centers, is noted, as 39 transmissions were made to Australia, DSS 43, and Spain, DSS 63. Author

N77-14065*# Joint Publications Research Service, Arlington, Va.
PREPARATION AND IMPLEMENTATION OF THE APOLLO-SOYUZ TEST PROJECT PROGRAM
K. D. Bushuyev Dec. 1976 57 p Transl. into ENGLISH from Kosmonavtika Astron. (Moscow), vol. 10, 1976 p 1-62
(NASA Order W-13183)
(NASA-TT-F-17502) Avail: NTIS HC A04/MF A01 CSCL 22A

The scientific and technical achievements attained by Soviet and American specialists during the preparation and implementation of the Apollo-Soyuz Test Project program are discussed. The results of the flight were analyzed in detail and the activities of the working groups participating in the development of the project were summed up. Author

N77-14066# European Space Agency, Paris (France).
MATERIAL SCIENCES IN SPACE
B. Battrick, ed Sep. 1976 509 p refs Proc. of 2d European Symp. held at Frascati, Italy, 6-8 Apr. 1976
(ESA-SP-114) Avail: NTIS HC A22/MF A01

Papers on electrophoresis, single crystals, melting and solidification of metals, glasses and ceramics, and fluid physics thermodynamics are presented. They provide an up-to-date appraisal of the theories and technology that can and are being applied in the manufacture of new and improved materials in space including the results of last year's Apollo Soyuz Test Project. For individual titles, see N77-14067 through N77-14119.

N77-14067# European Space Agency, Paris (France).
SHUTTLE AND SPACELAB CAPABILITIES **c16**
D. J. Shapland *In its* Mater. Sci. in Space Sep. 1976 p 3-18 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The Shuttle and Spacelab systems are described emphasizing recent developments. The potential that the Shuttle and Spacelab combination holds for users in general, and material scientists in particular, is stressed. The current status of the programs is reviewed, including the presentation of selected Spacelab hardware activities; recent developments in the Spacelab program that have an impact on its use are reported. Finally, the material scientist is introduced to the operational aspects of Spacelab payloads and to some of ESA plans for Spacelab utilization. Author (ESA)

N77-14068*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SUMMARY OF THE PRE-ASTP RESULTS
R. S. Snyder *In* ESA Mater. Sci. in Space Sep. 1976 p 19-26 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01 CSCL 22A

A general overview of materials experiments done on several Apollo missions and Skylab as well as the ground research that led to these experiments is given. Demonstrations of composite solidification, electrophoresis, and fluid flow were developed for Apollo. Fourteen different experiments in metal processing and single crystal growth were done in the space processing facility on Skylab. Metals were melted and solidified in a variety of configurations using different methods of heating to produce improved alloys and composite materials. Single crystals were grown by directional solidification and vapor transport to achieve uniform crystalline perfection, decreased structural defects, and homogeneity of the dopant material. Author (ESA)

N77-14069# Max-Planck-Institut fuer Biochemie, Martinsried bei Muenchen (West Germany).
REVIEW OF ELECTROPHORESIS EXPERIMENTS ON ASTP
K. Hannig and R. Schindler *In* ESA Mater. Sci. in Space Sep. 1976 p 27-31 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The scientific requirement for the electrophoresis experiment on the Apollo Soyuz Test Project (ASTP) flight arose from a study concerning the application of electrophoresis in future biological experiments on board Spacelab. It is expected that separation capability will be increased at zero gravity and that this will lead to new applications which depend on improved resolution. The experiments were devised to test electrophoresis hardware and to verify electrophoresis experiments by operation in space. Two different electrophoresis devices were flown on ASTP. In the experiments devised by American experimenters (MA-011) a static discontinuously working system was used. The apparatus was a development of the model already tested in the Apollo-14 and Apollo-16 electrophoresis demonstrations. In the German electrophoresis experiment (MA-014), a continuously working free-flow system was applied for the first time which allowed separations at high sample flow rates. In both experiments, mixtures of different cell population (red blood cells, lymphocytes, kidney cells and bone marrow cells) were separated. Author (ESA)

N77-14070# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
CRYSTAL GROWTH EXPERIMENTS ON ASTP: AN OVERVIEW
August F. Witt *In* ESA Mater. Sci. in Space Sep. 1976 p 33-40 (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The crystal growth experiments performed during the Apollo Soyuz Test Project (ASTP) mission involved growth from solution ($CaC_4H_4O_6$, $CaCO_3$, PbS), growth by vapor transport ($GeSe_{0.99}Te_{0.01}$, $GeS_{0.98}Se_{0.02}$ and GeS) and growth from the melt (Ge doped with Ga). Experimental results showed that growth under near-zero gravity conditions may lead to materials of superior crystalline and compositional perfection: they indicated further that some established concepts of crystal growth are basically deficient and require revisions. A quantitative analysis of the melt growth and segregation behavior confirmed, in principle, the establishment of favorable growth conditions on a microscale, demonstrated advantageous conditions for materials processing in space, and indicated the existence of several as yet unexplained phenomena with potentially far-reaching consequences.. Author (ESA)

N77-14071*# Case Western Reserve Univ., Cleveland, Ohio.
CONVECTION PHENOMENA AT REDUCED GRAVITY OF

IMPORTANCE FOR MATERIALS PROCESSING
S. Ostrach *In* ESA Mater. Sci. in Space Sep. 1976 p 41-56 refs (For primary document see N77-14066 05-12)
(Grant NAS8-31802)
Avail: NTIS HC A22/MF A01 CSCL 22A

The basic aspects of convection processes are delineated. It is shown that even in weak gravitational fields buoyancy can induce fluid motions. Furthermore, at reduced gravity other nongravity forces such as surface or interfacial tensions, g-jitter, therma-volume expansions, density differences due to phase changes, and magnetic and electric fields can induce fluid motions. The various types of flow possible with these various driving forces are described and criteria for determining the extent and nature of the resulting flows and heat transfer are presented. The various physical mechanisms that can occur separately and in combination are indicated and the present state of knowledge of each of the phenomena is outlined. Author (ESA)

N77-14072# European Space Agency, Paris (France)
ESA SPACELAB PAYLOAD PLANNING c16
J. Collet *In its* Mater. Sci. in Space Sep. 1976 p 57-61 (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

ESA Spacelab mission scheduling and planning is presented. Possible European mission models for Spacelab mission utilization are considered. Procedures for determining which facilities and experiments will be flown on the first Spacelab mission are outlined. ESA

N77-14073# European Space Agency, Paris (France).
MATERIAL-SCIENCE ACTIVITIES IN EUROPE
G. Seibert *In its* Mater. Sci. in Space Sep. 1976 p 63-71 (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

ESA's activities and tasks in space material science are described. Activities of the Material Science Consulting Groups are touched upon. For the first Spacelab payload, the recommended order of priority is discussed, and typical experiments are briefly described. Based on the requirements of typical material-science experiments, ESA has undertaken a number of equipment studies on, for example, isothermal and gradient furnaces, process chambers, etc. The results of these industrial studies are summarized. In addition, material-science activities in the different European countries are reviewed. Author (ESA)

N77-14074# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
OVERVIEW OF THE MATERIAL SCIENCE PROGRAMME IN GERMANY
G. Greger *In* ESA Mater. Sci. in Space Sep. 1976 p 73-80 (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

Over the past two years, research and technology activities have been substantially increased within the BMFT space-processing program in various areas of application. Experts from universities, research institutes, and industry have been assembled into planning and advisory groups for the projection and planning of long-term applications. Guidelines for envisaged priorities have been laid down and objectives for promotional measures delineated. Within this program, major supporting research and technology activities, feasibility, and definition studies for selected experiments and pilot payloads combined with long-term planning activities have been initiated to establish materials laboratories for Shuttle/Spacelab flights. A preparatory program with sounding-rocket flights has been decided upon. Author (ESA)

N77-14075*# National Aeronautics and Space Administration, Washington, D.C.
THE NASA SPACE PROCESSING PROGRAM
James H. Bredt *In* ESA Mater. Sci. in Space Sep. 1976 p 81-86 (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01 CSCL 22A

The program is intended to initiate utilization of spaceflight for economically beneficial activities in all branches of materials science and technology. In view of the prospect they offer for reducing the costs of space operations, the Spacelab and Space Shuttle are expected to become widely used for work on materials early in the 1980's. At first they will be employed for space experiments and for services, such as sample preparation, that support research and development activities on the ground. Orbital manufacturing operations are expected to develop as well when research has prepared an adequate basis for them. During the past year, NASA has initiated a series of rocket flights on which prospective participants in the Shuttle/Spacelab program can perform preliminary experiments. Participation in these flights is open to investigators from all countries, and experiments are being solicited from private sponsors also. NASA is performing concurrent definition studies of Shuttle/Spacelab payloads, and design work on equipment for the first two years of operations is planned to begin early in 1977. The Office of Applications currently plans to fly two space processing payloads on Orbital Flight Test missions in 1980 and two on operational Spacelab missions in 1981. Author (ESA)

N77-14076*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE PROCESSING PAYLOAD EXPERIMENT REQUIREMENTS
K. R. Taylor *In* ESA Mater. Sci. in Space Sep. 1976 p 87-113 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01 CSCL 22A

An overview is given of the definition of research requirements and derivation of engineering design requirements for a group of 77 representative applications of space processing. Representative requirements are documented for applied research in space on biological processes, chemical/fluid phenomena, solidification processes, and glass/ceramics processes. Design requirements for payload equipment to accomodate these research requirements are presented in engineering terms, such as power requirements, schematic diagrams, etc. In addition, a summary of the 77 applied research topics is included. Author (ESA)

N77-14077# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
ACCOMMODATION OF EUROPEAN MATERIAL-SCIENCE EXPERIMENTS ON SPACELAB c16
P. Zimmermann *In* ESA Mater. Sci. in Space Sep. 1976 p 115-127 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The results of a preliminary accommodation study performed under ESA direction are summarized. Hardware items for a potential material-science payload were identified and specified by analyses of typical reference experiments. A set of general-purpose facilities (various heating facilities, fluid-physics module, and electrophoresis processing facility) and experiment-peculiar equipment was derived. A commonality analysis and operational requirements for experiments led to the definition of centralized support equipment (control/monitoring console, common power, vacuum, and noble-gas supply). The identified inventory was built up modularly in order to meet the varying requirements of metallurgical, crystal-growth, glass, fluid-physics, and electrophoresis experiments. Each of the facilities/equipment is specified with respect to its physical and operational capabilities. The test and model philosophy applied is aimed at a low-cost program which, nevertheless, provides confidence in the safe operation of facilities/equipment. Author (ESA)

N77-14078# Simon Stevin Instituut voor Wetenschappelijk Onderzoek, Brugge (Belgium).
SEPARATION METHODS IN SPACE BIOLOGY c51
H. Peeters *In* ESA Mater. Sci. in Space Sep. 1976 p 129-133 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

Methods to be used in experiments are reviewed with the specific circumstances of the weightless environment in mind. The primary parameters pertinent to the environment of a space laboratory and likely to affect separation include gravity, temperature, air pressure, and the air composition in the spacecraft. A second set of factors include the available power, cooling and storage capacities, controls and data acquisition, and - most important of all - the ability of the crew to manipulate the equipment and cope with its problems even when it is automated. Equipment design and experimental design follow from the previous conditions and generate a feedback for the power systems, etc. Design problems must also take into account the landing and re-entry of the separation equipment and the time

lapse between launch and recovery of the biological samples. Using these general parameters as a basic set of rules, a method-by-method discussion of each separation technique can be organized logically. In a further stage, the separation methods are then to be incorporated into actual space experiments and this can be done either on an analytical or on a preparative scale, while a measure of the need for separation during a given space experiment can also be devised. It appears that quite a number of logistic problems have to be overcome before a decision can be reached on the practical feasibility or de facto applicability of a separation method within the design of a given spacebiology experiment. Author (ESA)

N77-14079# Max-Planck-Institut fuer Biochemie, Martinsried bei Muenchen (West Germany).

DETAILED RESULTS OF ASTP EXPERIMENT MA-014 (CONTINUOUS-FLOW ELECTROPHORESIS) c25

K. Hannig and H. Wirth *In* ESA Mater. Sci. in Space Sep. 1976 p 135-140 (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The background of the mission was to verify free-flow electrophoresis under space conditions with high sample throughput as a result of a large gap width, made possible by the absence of thermal convection. A lot of normally unencountered difficulties had to be overcome, such as the long sample rest periods during liftoff preparation, depressurization of the cabin, absolute sealing of the fluid loops and sample inputs, re-suspension of the sample in the absence of gravity, and separation and absorption of the electrophoretically produced hydrogen. The experimental results were satisfying in that all systems worked well, except the illumination of the optical detection system. In spite of this malfunction the data processing revealed electrophoretic distribution patterns that can be compared with those appearing under earth conditions. They show high resolution capability at sample throughputs normally unattainable (on earth).
Author (ESA)

N77-14080# Case Western Reserve Univ., Cleveland, Ohio.

THE INFLUENCE OF CONVECTION IN CONTINUOUS-FLOW ELECTROPHORESIS c25

S. Ostrach *In* ESA Mater. Sci. in Space Sep. 1976 p 141-147 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The various types of convection possible in an electrophoresis device are indicated and criteria are presented from which estimates can be made of the importance of convection in the separation. These criteria also indicate design options possible to suppress or reduce convection effects. Specific consideration is given to the convection induced by Joule heating in a representative continuous-flow electrophoresis configuration. Detailed solutions for the associated velocity and temperature distributions are presented and it is shown how they are influenced by the buffer throughput, wall cooling, and electric field strength. Author (ESA)

N77-14081# Max-Planck-Institut fuer Biochemie, Martinsried bei Muenchen (West Germany).

IMMUNOLOGICAL ASPECTS IN SPACE EXPERIMENTS AND THE POSSIBILITIES OF CELL SEPARATION BY CONTINUOUS-FLOW ELECTROPHORESIS c51

D. Leihener *In* ESA Mater. Sci. in Space Sep. 1976 p 149-154 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The heterogeneity of cells from lymphatic organs such as bone marrow, spleen, or thymus complicates the study of immunological responses, processes of differentiation, and regulation of lymphocytes. A direct experimental approach to the problem would be to separate and classify individual types of cells. The surface charge on a lymphoid cell is a biologically important parameter and separation on the basis of this property should reflect quite different aspects of the cell from sedimentation or buoyant density procedures. Free-continuous-flow electrophoresis makes it possible to separate mixtures of B- and T-lymphocytes and even subsets of these different cell types. A better resolution of cell bands under space conditions (no sedimentation and thermoconvection) leads to a higher enrichment of specific lymphocyte subpopulation, which can be investigated in further immunological Spacelab experiments. A promising experiment in this direction would be to use suspended cell cultures to study the mechanism of T- and B-cell cooperation under better defined conditions. Author (ESA)

N77-14082# Oregon Univ., Portland. Health Sciences Center.

DETAILED RESULTS OF ASTP EXPERIMENT MA-011 c51

G. V. F. Seaman, R. E. Allen (NASA, Marshall Space Flight Center), G. H. Barlow (Abbott Labs., Chicago), and M. Bier (Veteran's Admin. Hosp., Tucson, Ariz.) *In* ESA Mater. Sci. in Space Sep. 1976 p 155-166 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01 CSCL 06B

This experiment was developed in order to conduct engineering and operational tests of electrokinetic equipment in a micro-gravity environment. The experimental hardware in general functioned as planned and electrophoretic separations were obtained in space. The results indicated the development of satisfactory sample collection, return, and preservation techniques. The application of a near-zero zeta potential interior wall coating to the experimental columns, confirmation of biocompatibility of all appropriate hardware components, and use of a sterile operating environment provided a significant step forward in the development of a biological processing facility in space. A separation of a test of aldehyde-fixed rabbit, human, and horse red blood cells was obtained. Human kidney cells were separated into several components and viable cells returned to earth. The isotachophoretic separation of red cells was also demonstrated. Problems associated with the hardware led to a lack of success in the attempt to separate subpopulations of human lymphocytes.
Author (ESA)

N77-14083# British Aircraft Corp. (Operating) Ltd., Bristol (England). Electronic and Space Systems Group.

PRELIMINARY STUDY OF A GENERAL-PURPOSE FLOATING-ZONE ELECTROPHORESIS FACILITY FOR SPACELAB c51

G. Lewis, P. R. Foster (Scot. Natl. Blood Transfusion Serv.), and B. White (Scot. Natl. Blood Transfusion Serv.) *In* ESA Mater. Sci. in Space Sep. 1976 p 167-174 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

A study recently undertaken in the U.K. of the scientific and technical problems inherent in the design, construction, and operation of a containerless floating-zone electrophoresis facility suitable for general use in Spacelab is presented. The feasibility of maintaining such a zone was assessed theoretically from the standpoint of fluid physics, and a neutral buoyancy test rig is under construction to verify some of the basic theory. A sub-scale demonstration unit is to be built to test progressively the formation of a static containerless floating zone, the effect of electrodes on such a zone, the formation of a continuous-flow floating zone, and finally the process of electrophoretic separation in the continuous-flow floating zone. It is hoped to make several sounding-rocket flights under microgravity conditions to assess and improve the performance of the apparatus before deciding on a final design suitable for flight on Spacelab. Author (ESA)

N77-14084*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.

CONTINUOUS-FLOW ELECTROPHORETIC SEPARATOR FOR BIOLOGICALS c51

L. R. McCreight, R. N. Griffin, and R. J. Locker *In* ESA Mater. Sci. in Space Sep. 1976 p 175-179 Sponsored in part by NASA (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01 CSCL 06B

In the near absence of gravity, a continuous-flow type of electrophoretic separator can be operated with a much thicker separation chamber than is possible under 1 g conditions. This should permit either better resolution or shorter separation time per unit of sample. An apparatus to perform experiments on sounding rockets is under development and will be described. The electrophoresis cell is 5 mm thick by 5 cm wide with 10 cm long electrodes. It is supplied with buffer, sample, and coolant at about 4 C through the use of a passive refrigerant system. UV sample detection and provision for recovery and cold storage of up to 50 sample fractions are now being added to the basic unit. A wide range of operating conditions are electronically

programmable into the unit, even up to a short time before flight, and a further range of some parameters can be achieved by exchanging power supplies and by changing gears in the motor drive units of the pump. The preliminary results of some separation studies on various biological products using a commercially available electrophoretic separator are also presented. Author (ESA)

N77-14085*# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.

QUANTITATIVE DETERMINATION OF ZERO-GRAVITY EFFECTS ON CRYSTAL GROWTH FROM THE MELT (EXPERIMENT MA-060)

H. C. Gatos, C. J. Herman, M. Lichtensteiger, and A. F. Witt *In* ESA Mater. Sci. in Space Sep. 1976 p 181-187 refs Sponsored in part by NASA (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01 CSCL 22A

The purpose of experiment MA-060 was to investigate quantitatively the effects of near-zero gravity conditions on crystal growth and dopant segregation during directional solidification from the melt. Gallium-doped germanium single crystals were successfully grown from the melt with simultaneous interface demarcation during the Apollo Soyuz Test Project mission. The analysis of the experimental data indicates striking differences of dopant segregation and growth behavior in the presence and absence of gravity. The results obtained are believed to have far-reaching implications on materials processing under zero-gravity conditions and on the theory of crystal growth and segregation in general. Author (ESA)

N77-14086*# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Chemistry.

CRYSTAL GROWTH FROM THE VAPOUR PHASE (ASTP EXPERIMENT MA-085)

H. Wiedemeier, H. Sadeek, F. C. Klaessig, M. Norek, and R. Santandrea *In* ESA Mater. Sci. in Space Sep. 1976 p 189-206 refs Sponsored by NASA (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01 CSCL 22A

The positive effects of microgravity on crystal quality and fundamental properties of the vapor transport reaction were established by analyzing the results of three transport experiments on multi-component systems performed during the Apollo Soyuz Test Project (ASTP) mission. The systems employed were GeSe(0.99)Te(0.01) - GeI4 (A), GeS(0.98)Se(0.02) - GeCl4 (B), and GeS - GeCl4-Ar (C). The crystallographic analysis is based on a direc5 comparison of space and ground-based (prototype) crystals, employing X-ray diffraction, microprobe, microscopic, and chemical etching techniques. The results demonstrate a considerable improvement of the space-grown crystals in terms of chemical and crystalline homogeneity, surface morphology, and bulk perfection relative to ground specimens. The confirmation of greater mass transport rates than predicted for micro-gravity by present vapor transport models is of basic scientific and practical importance for the improvement of transport models and techniques on earth and for the development of a transport model for space conditions. The internal consistency and agreement between ASTP and Skylab results obtained for different compounds, transport agents, and temperature gradients strongly support the validity of these observations. The combined findings of improved crystal quality and high mass transport rates are of technological significance for space-processing applications. Author (ESA)

N77-14087# Erlangen-Nuremberg Univ. (West Germany).

CRITERIA FOR SELECTION OF CRYSTAL-GROWTH TECHNIQUES

H. Weiss *In* ESA Mater. Sci. in Space Sep. 1976 p 207-212 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The starting point for crystal-growth techniques is determined by the properties expected of the material to be produced. Growth in space is characterized by the absence of gravity, which also means the absence of convection and introduces the possibility of zone-melting. The selection of growth techniques involves heating methods as well as materials. The latter include technically and economically important crystals like silicon, and model substances like InSb for basic studies of crystal growth. Close cooperation between the fluid-mechanics and crystal-growth disciplines is necessary for future success in this field. Author (ESA)

N77-14088# Erlangen-Nuremberg Univ. (West Germany).

CRYSTAL GROWTH AT GREATER THAN 1 g **c76**

G. Mueller *In* ESA Mater. Sci. in Space Sep. 1976 p 213-216 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The perfectness of crystals grown from the melt is strongly influenced by surface tension and gravitational convection effects. Up to now, the processes of crystal growth have been studied only under conditions of terrestrial gravity or in some cases under space conditions (approximately zero gravity). A preparation of experiments for variable accelerations above 1 g is reported. The results of these experiments should provide a better understanding of problems involved in crystal growth from the melt. In particular, they should support the preparation of some Spacelab experiments. The experimental arrangement consists of a tube furnace which can be accelerated on a centrifuge up to 50 g. The tube axis can be adjusted parallel and perpendicular to the direction of acceleration. In the first series of experiments, InSb and InSb-NiSb eutectic will be used. Frequency, amplitude, and phase correlation of temperature oscillations in the melt as a function of acceleration will be measured. Author (ESA)

N77-14089# Stuttgart Univ. (West Germany). Inst. fuer Physik.

CRYSTAL GROWTH OF III-V SEMICONDUCTORS UNDER ZERO-GRAVITY CONDITIONS

K. W. Benz and H. Weiss (Erlangen-Nuernberg Univ.) *In* ESA Mater. Sci. in Space Sep. 1976 p 217-222 refs (For primary document see N77-14066 05-12)
(Contract BMFT-RV21-V91/74-KA-50)
Avail: NTIS HC A22/MF A01

Used as basic materials for opto-electronic (GaAs, GaP), microwave (GaAs), and galvanomagnetic (InSb) devices are III-V semiconductor crystals, e.g. GaAs, GaP, and InSb. The properties of some technically important III-V compounds in terms of their crystal-growth methods are briefly discussed. The crucible-free floating-zone technique is a promising method for improving the quality of these crystals, which means especially low dislocation densities and homogeneous dopant distributions. Crystal growth from melts by this method may be applied to GaSb and InSb, and crystal growth from solutions to InSb, GaSb, GaAs, GaP, and InP. Author (ESA)

N77-14090# Battelle Inst., Frankfurt am Main (West Germany).

HEAT FLOW, DIFFUSION AND CONVECTION IN THE TRAVELLING-SOLVENT METHOD **c34**

D. Langbein *In* ESA Mater. Sci. in Space Sep. 1976 p 223-230 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The equations describing heat and particle flow during crystal growth by the traveling-solvent method were developed. The thermal radiation across the surface, the heat of fusion arising at the interfaces, the change in thermal conductivity in the crystal and the solvent, and the travel rate were taken into account. By expanding both the temperature profile and the particle concentration in the vicinity of the crystal axis, analytical solutions were obtained in all crystal and solvent regions. The heat flow enforced by the travel rate causes the temperature gradient in the feed crystal to become steeper than that in the growing crystal. The position and temperature of the dissolving and of the growing interfaces are fixed by the particle flow. The effect of convection is a levelling of the temperature in the solvent, an increase in the temperatures at the dissolving and the growing interfaces, and an extension of the solvent zone. Convection tends to become unstable and favors supercooling. Zero gravitation avoids convection. Heat and particle flow stabilize mutually and suppress supercooling. Author (ESA)

N77-14091# Centre National de la Recherche Scientifique, Meudon (France).

BRIDGMAN TECHNIQUE IN SPACE: POSITIONING PROBLEMS IN THE CASE OF VOLATILE COMPONENTS

[TECHNIQUE DE BRIDGMAN DANS L'ESPACE: PROBLEMES DU POSITIONNEMENT DANS LE CAS DE COMPOSANTS VOLATILS]

H. Rodot *In* ESA Mater. Sci. in Space Sep. 1976 p 231-240 refs In FRENCH; ENGLISH summary (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The main features of the so-called Bridgman method of growing single crystals are described, in particular for compounds including volatile elements. The advantages of this technique for terrestrial uses, as well as the limitations imposed by gravity on the quality of the grown crystals, are discussed. Crystal growth in space allows the crystal to be obtained from a liquid under conditions of weak convection and without crucible. It is shown how comparison of the properties of crystals grown under 1 g and 0 g conditions permits understanding the relative contributions of the various parameters that influence and perturb crystal growth. The influence of the various parameters affecting the technique on the origin of convection in the liquid is studied and an attempt is made to define the best possible conditions for growth in space. Various methods that can be used to apply this technique in space are examined, particular attention being paid to the possibilities for positioning the liquid during crystallization in a sealed tube. Author (ESA)

N77-14092# Freiburg Univ. (West Germany). Inst. fuer Kristallographie.

A RADIATION FURNACE FOR ZONE-CRYSTALLISATION EXPERIMENTS IN SPACE **c35**

A. Eyer, H. Zimmermann, and R. Nitsche *In* ESA Mater. Sci. in Space Sep. 1976 p 241-244 Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

A highly efficient radiation furnace for space processing of materials was constructed. It consists of two elliptical mirrors with a common focus, joined together in a completely closed, rugby-ball-like arrangement which allows experiments in any atmosphere, and even in vacuum. Performance tests were carried out with a version with ellipsoidal axes a=100 and b=c=80 mm (effective solid angle = 3.76). Temperatures exceeding 2300 K can easily be achieved in a volume of about 1 cu cm with two commercially available 400 W tungsten-filament lamps. The furnace is equipped with rotation and pulling devices for growing crystals by the floating-zone or traveling-heater techniques. Zone thickness is controlled electronically. The furnace is thought to have general application for space-processing of materials because it constitutes a clean, highly directional heat source of extremely low thermal inertia, which can provide very high as well as very low heating and cooling rates. Preliminary results of crystal-growth experiments with various materials (Si, AlO3) are reported. Author (ESA)

N77-14093# Laboratoires d'Electronique et de Physique Appliquee, Paris Limeil-Brevannes (France).

REVIEW OF EUROPEAN PROPOSALS FOR VAPOUR GROWTH

C. Belouet *In* ESA Mater. Sci. in Space Sep. 1976 p 245-248 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

It is shown that vapor growth in a micro-gravity environment should provide bulk or layer-type single crystalline materials exhibiting a higher degree of perfection and improved performance characteristics when compared with earth-grown materials. The range of applications and the anticipated benefits of vapor growth in zero-gravity conditions are briefly reviewed, together with the tentative European proposals for the first Spacelab flight.
Author (ESA)

N77-14094# Portsmouth Polytechnic (England). Dept. of Physics.

MEASUREMENT OF PROPERTIES OF HIGH-TEMPERATURE SOLUTIONS **c76**

D. Elwell *In* ESA Mater. Sci. in Space Sep. 1976 p 249-253 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The design of apparatus and choice of optimum conditions for the growth of crystals in bulk or as epitaxial films requires a knowledge of a range of properties of the solutions. The most important are those that affect the transport of solute in the bulk of the solution and in the boundary layer adjacent to the crystal surface. A brief review is given of theoretical models which describe the growth rate of crystals from solution and also the conditions for stable growth. The measurement under 1 g conditions of such parameters as solution viscosity, density, and surface tension are discussed. The greatest problems concern the determination of thermal and solute diffusion coefficients, and a proposal is outlined to measure the latter parameter on Spacelab. Author (ESA)

N77-14095# Technical Univ. of Denmark, Lyngby.

DIFFUSION GROWTH OF ORGANIC CHARGE-TRANSFER CRYSTALS **c76**

K. F. Nielsen *In* ESA Mater. Sci. in Space Sep. 1976 p 255-258 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

Since the discovery of one-dimensional conductivity with a peak at 60 K in single crystals of tetra-thiofulvalene-tetracyanoquinodimethane, a number of organic charge-transfer salts have become interesting as a basically new type of electronic material. Crystal growth of these compounds is usually achieved by opposite oriented diffusion in liquid solution. In a low-viscosity liquid, this cannot be achieved on earth for any length of time, since the concentration gradients give rise to density gradients, which in turn give rise to convection currents. A package of crystal-growth experiments for Spacelab is suggested, and the follow-up research on earth is described. Author (ESA)

N77-14096# Battelle Inst., Frankfurt am Main (West Germany).

OBSERVATIONS, ESTIMATES AND SUGGESTED EXPERIMENTS RELATING TO SURFACE-TENSION-INDUCED THERMOCONVECTION

R. Beck, K. Guers, and G. Seger *In* ESA Mater. Sci. in Space Sep. 1976 p 259-263 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

During crystal-growth experiments using the method of crucible-free zone melting with CO2 laser, substantial fluid flow due to the temperature-dependent surface tension was observed. This effect in some cases led to motions in the melt that were stronger than the gravity-induced thermoconvection and would not be reduced under microgravity conditions. Therefore, when selecting the Spacelab experiments, the surface-tension-induced convection has to be taken into account. Theoretical considerations and experiments proposed to measure the temperature dependence of the surface tension and the motions in the melt are discussed. Author (ESA)

N77-14097# Polytechnical Univ. of Madrid (Spain). Escuela Tecnica Superior de Ingenieros Aeronauticos.

FLUID-PHYSICS-MODULE EXPERIMENTS **c34**

I. Da-Riva and J. M. Ruesga (Construcciones Aeronauticas S. A.) *In* ESA Mater. Sci. in Space Sep. 1976 p 265-275 refs Sponsored by Comision Nacl. de Invest. del Espacio (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

Some floating-liquid-zone experiments performed under reduced-gravity conditions are reviewed. Several types of instabilities are discussed, together with the relevant parameters controlling them. It is shown that the bounding values of these parameters could be increased, by orders of magnitude in several instances, by selecting appropriate liquids. Two of the many problems that a fluid-physics module, devised to perform experiments on floating zones in a space laboratory, would involve are discussed: namely (I) procedures for disturbing the zone under controlled conditions, and (II) visualization of the inner flow pattern. Several topics connected with the nonisothermal nature and the phase-changes of floating zones are presented. In particular, a mode of propagation through the liquid zone for disturbances which could appear in the melting solid/liquid interface is suggested. Although most research on floating liquid zones is aimed at improving the crystal-growth process, some additional applications are suggested. Author (ESA)

N77-14098# Polytechnical Univ. of Madrid (Spain). Escuela Tecnica Superior de Ingenieros Aeronauticos.

FLOATING ZONE UNDER REDUCED GRAVITY. AXISYMMETRIC EQUILIBRIUM SHAPES **c34**

I. MartinezHerranz *In* ESA Mater. Sci. in Space Sep. 1976 p 277-282 refs Sponsored by Comision Nacl. de Invest. del Espacio (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The mathematical formulation of the problem of calculating the axisymmetric equilibrium shapes of an incompressible fluid mass, held by surface-tension forces between two parallel coaxial discs and rotating about its axis was considered. The effect of gravity was neglected. Both variational methods, based on extreme kinematic potential, and curvature methods, based on local equilibrium conditions, were used to calculate the form of the equilibrium surface. The stability of the zone of axisymmetric perturbation was considered in detail. Author (ESA)

N77-14099# Laboratoires d'Electronique et de Physique Appliquee, Paris Limeil-Brevannes (France).
FLUID-DYNAMICS PROBLEMS CONNECTED WITH CRYSTAL GROWTH **c34**

C. Belouet *In* ESA Mater. Sci. in Space Sep. 1976 p 283-289 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

It is stressed that the growth of single crystals is influenced to a large extent by the heat and mass transports in the fluid where growth occurs. It is shown that, due to the absence of a gravity field, space-growth could furnish more perfect as well as new materials, provided an intensive study of fluid physics is conducted in this particular environment. It is also shown that new quantitative data will be obtained in fluid physics which should result in an improvement of theoretical models for earth growth. Author (ESA)

N77-14100# Royal Inst. of Tech., Stockholm (Sweden).
POSSIBLE DENDRITE GROWTH AND SEGREGATION PHENOMENA DURING SOLIDIFICATION OF ALLOYS IN SPACE **c26**

H. Fredriksson *In* ESA Mater. Sci. in Space Sep. 1976 p 291-299 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The influence of zero gravity on the concentration and temperature distribution around a growing dendrite in a binary alloy is discussed. The concentration and temperature distribution determine the formation of primary and secondary dendrite arms. The mechanism of this formation in a system free from thermal convection is discussed. The stability of the growth direction of a dendrite under zero gravity is also examined. Microsegregation during dendritic growth under zero gravity and on earth are compared. Such segregation in a binary alloy can cause macrosegregation by interdendritic convection in the melt. On earth this convection can be caused by density differences in the melt or by solidification shrinkage. The possibility of distinguishing between these two types of macrosegregation by zero-gravity experiments is discussed. Author (ESA)

DATA SUMMARY: Convection effects on temperature and/or concentration distribution around growing dendrite tip; variables include temperature distribution, concentration distribution, isoconcentration, distance from cooling surface, dendrite arm space; 3 figures include numeric data.

N77-14101# Fulmer Research Inst. Ltd., Stoke Poges (England).
IMMISCIBLE-ALLOY EXPERIMENTS IN SPACE **c26**

C. D. Desforges *In* ESA Mater. Sci. in Space Sep. 1976 p 301-308 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The principles of immiscible-alloy solidification with reference to terrestrial and reduced-gravity environments are reviewed. An analysis and critique of experiments carried out on immiscible-alloy systems is presented and a review of the proposed experiments for Spacelab flights is outlined. Specific features of these experiments are described in terms of the relevant physical and chemical parameters. Author (ESA)

DATA SUMMARY: Aluminum-lead system remains as distinct phases when mixed at any given temperature; variables include temperature, lead weight percent; 1 figure includes numeric data.

N77-14102# Hamburg Univ. (West Germany).
POSSIBILITIES FOR IMPROVING ALLOYS WITH SPECIAL PHYSICAL PROPERTIES IN SPACE **c26**

H. Ahlborn *In* ESA Mater. Sci. in Space Sep. 1976 p 309-311 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

Many alloys with special physical properties, e.g., magnetic, electrical, mechanical, optical, are normally used in small quantities and are expensive; therefore, they would, ideally, be suited to preparation and improvement in space. Weightlessness in space will allow production of immiscible alloys in the molten state (used, for example, as bearing materials), as well as the preparation of two- or multi-phase materials with homogeneously distributed particles by a melting process. Neither process can be performed on earth because of gravity segregation. The resulting space-prepared materials would have no pores or particle clusters typical of composite materials produced by powder metallurgical methods on earth. The absence of thermal convection would favor the production of directional solidified eutectic alloys with improved structures, resulting in improved anisotropic properties. The possibility of crucible-free melting in space can be used for the production of alloys with a lower impurity content and can, for example, markedly influence magnetic properties.
Author (ESA)

DATA SUMMARY: Theoretical and best experimental values for five magnetic materials; variables include eutectic composition and static energy production; 1 figure includes numeric data.

N77-14103# Commissariat a l'Energie Atomique, Grenoble (France).
REVIEW OF POSSIBLE EUTECTIC-ALLOY SOLIDIFICATION AND THERMODIFFUSION EXPERIMENTS **c26**

Y. Malmejac *In* ESA Mater. Sci. in Space Sep. 1976 p 313-317 (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

Some of the precautions for two important fields of materials science, eutectic growth and mass transport phenomena in the liquid phase under a temperature gradient, are defined in order to provide investigators with some up-to-date advice based on results of the Skylab and ASTP programs. The interest and conditions of preliminary measurements of the coefficient of the Soret effect are discussed. ESA

DATA SUMMARY: No numeric data are presented.

N77-14104# Maschinenfabrik Augsburg-Nuernberg A.G., Munich (West Germany). Advanced Technology Div.
QUALITY IMPROVEMENT FOR SPACE-PROCESSED TURBINE BLADES

P. Leven and A. Rossmann (Motoren- und Turbinen-Union Muenchen G.m.b.H.) *In* ESA Mater. Sci. in Space Sep. 1976 p 319-332 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

Problems involved in the manufacturing of turbine blades under terrestrial conditions are pointed out and conceivable space technologies that can lead to their solution were proposed by means of a new technique called skin technology. Turbine blades based on directionally solidified eutectics and chromium can be coated with a thin refractory layer by plasma spraying, chemical vapor deposition, and cementation. In space these pre-prepared gas turbine blades can be heat-treated, remelted, and solidified without changing their geometry. The possibilities that such treatment in a zero-gravity environment offer for the development of gas-turbine materials are discussed. Author (ESA)

N77-14105# Battelle Inst., Frankfurt am Main (West Germany).
HARDWARE DEVELOPMENT AND PERFORMANCE TESTING OF AN ACOUSTICAL POSITIONING DEVICE **c71**

E. G. Lierke *In* ESA Mater. Sci. in Space Sep. 1976 p 333-339 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

Multiaxial positioning of spherical samples in cylindrical tubes (furnaces) excited with one transducer to standing waves of the 1.0 Bessel mode (1 node circle) is reported. Interference with plane waves is suppressed by mode-shaping (special

transducer and reflector design) and by automatic resonance tuning of the desired wave mode. The device is operated under nearly isothermal conditions. Temperature variations (wavelength changes) are compensated by either automatic control of the transducer-reflector distance (small-range variation) or by composition control of a two-component gas mixture (large-range variation). In terrestrial tests, glass and steel samples with a diameter d up to one half of the acoustical wavelength have been levitated in different directions with a total power consumption of less than 10 W. Author (ESA)

DATA SUMMARY: Normalized sound velocities of three possible wave modes; variables include normalized sound velocity, piston transducer radiation, temperature, displacement amplitude, ambient conditions; 3 figures include numeric data.

N77-14106*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FACILITIES AND EXPERIMENT RESULTS OF THE NASA SOUNDING ROCKET PROGRAM c15
R. S. Snyder *In* ESA Mater. Sci. in Space Sep. 1976 p 341-349 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The NASA rocket program on reduced gravity materials experiments is reported, including experimental results obtained from the single-stage Black Brant VC sounding rockets first flight and the developed equipment. The first flight was made on 11 December 1975, and nine different experiments were done in the five min of weightlessness. All systems operated satisfactorily and each experiment generated interesting results and recorded phenomena that have been reported. Each of the experiments will be flown again in modified form to obtain additional data or check unexpected results on the multiple rocket launches planned each year. General-purpose apparatus and facilities are being developed and built to allow repeated experimentation of various materials by different investigators. For example, multiple-cavity furnaces with rapid heat-up and cool-down possibilities, providing isothermal and gradient thermal profiles, will accommodate a wide variety of solidification experiments. Special hardware satisfying specific individual requirements is also being developed. Author (ESA)

N77-14107# Universite Catholique de Louvain (Belgium). Lab. de Metallurgie Physique.
REVIEW OF COMPOSITE MATERIALS c24
A. Berghezan *In* ESA Mater. Sci. in Space Sep. 1976 p 351-364 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The possibilities offered by space conditions for preparing isotropic composite materials by homogeneous dispersion of short fibers and/or particles in a molten metal matrix are analyzed in brief. Uniform dispersion of the fibers, as well as good bonding between fibers and matrix, requires, besides zero gravity conditions, both good wetting between the fibers and matrix, and outgassing of the molten metal matrix. Improvement of the wetting of certain fibers (such as carbon W-fibers) by different molten metal or alloy matrices is reviewed and some new results are reported. A method of degassing in space is proposed; it consists of displacing the gas bubbles from one end of the ingot to the other by unidirectional movement of the solidification front. Finally, some further problems associated with composite materials in space, such as the handling of short fibers and powders and their incorporation into the molten metal, are discussed. Author (ESA)

DATA SUMMARY: Contact angle/time for copper alloys in virtreous carbon and HX 30 graphite; variables include surface tension, concentration, time from melting, contact angle; 2 figures include numeric data.

N77-14108# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
UNIDIRECTIONAL SOLIDIFICATION APPARATUS FOR SOUNDING ROCKETS c35
L. R. McCreight, M. J. Noone, and R. J. Locker *In* ESA Mater. Sci. in Space Sep. 1976 p 365-368 (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

An automated directional solidification system developed to perform systematic studies of the effects of near-zero gravity on the development of solidification microstructures under conditions similar to those used in terrestrial studies of solidification phenomena is described. Four cylindrical furnace/quench-block assemblies can be separately programmed to provide temperatures up to 1600 C and translational speeds between 0.5 and about 10cm/min. with respect to a coaxial stationary crucible containing the specimen. The watercooled copper quench blocks are attached to one end of each furnace to provide rapid cooling of the test specimens while maintaining a steep temperature gradient in the liquid ahead of the solidification interface. The specimens are rods 2 to 5 mm in diameter and up to 10 cm long, enclosed in cylindrical crucibles 4 to 7 mm OD of alumina, graphite, silica, or steel. The entire apparatus may be operated in an inert atmosphere and is equipped with automatic preset controls and various sensors to provide operational data by telemetry during flight. Author (ESA)

N77-14109# Bologna Univ. (Italy). Ist. di Fisica.
DISPERSION-HARDENED-ALLOY EXPERIMENTS c26
P. Gondi *In* ESA Mater. Sci. in Space Sep. 1976 p 369-374 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

Some of the problems connected with the preparation of dispersion-hardened alloys by introduction of the solid dispersed phase into the liquid metal, paying special attention to the opportunities offered by zero-gravity conditions, are dealt with. Solid particles dispersed in molten metals should not show appreciable segregation for radii smaller than 0.00001 cm. Experiments on the ground with dispersed particles below this limit showed segregation or thixotropy because of particle aggregation leading to large effective radii. To avoid aggregation effects due to surface-tension convection in zero gravity the possibility of using the oxide film on the metal as 'container' was examined. The conditions for bubble growth or shrinkage, with or without dissolved gases, are discussed with particular reference to the limit represented by the critical radii, and to the dispersed-particle effects on the critical radii themselves. Author (ESA)

DATA SUMMARY: dissolution of bubble containing two gases; variables include displacement from settling, random walk, particle radius, contact angle, time, bubble radius; 3 figures include numeric data.

N77-14110# Technische Univ., Berlin (West Germany). Inst. fuer Metallforschung und Metallkunde.
RESULTS OF WETTING-BEHAVIOUR STUDIES c24
K. Loehberg *In* ESA Mater. Sci. in Space Sep. 1976 p 375-380 refs Sponsored by DFVLR (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

To produce composite in space, adhesion as high as possible between the two components is required. The greatest coherency between components seems to be established by chemical bonds, and a measure of this bonding may be the wetting behavior between the liquid metallic matrix and the other components. Another requirement is chemical compatibility of the components. There may be a high reactivity rate between the liquid metal and the ceramic component which may damage the latter. In this case, it is possible to cover the ceramics with a coating material which adheres to them well and is sufficiently wetted by the melt. Some investigations into the system aluminum-carbon fiber with an interlayer of TiN, are described. There may be no reactivity, or only an indolent one, between the two components and therefore insufficient wettability exists. In this case, any interface-active elements may be added to the melt resulting in an increase of the wettability. Some investigations into the aluminum-Al2O3 system with additions of rare-earth metals are described. Author (ESA)

DATA SUMMARY: Surface energy of liquid aluminum and liquid Al-Si 12; variables include temperature, surface energy, contact angle, time, free energy; 5 figures and 1 table include numeric data.

N77-14111# Technische Universitaet, Clausthal-Zellerfeld (West Germany).
MELTING OF A PbAgBaO-POWDER ALLOY IN A ZERO-GRAVITY ENVIRONMENT (ROCKET FLIGHT) **c24**
W. Heye and M. Klemm *In* ESA Mater. Sci. in Space Sep. 1976 p 381-390 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The preparation and treatment of a PbAgBaO alloy is described, especially deformation behavior by extrusion and subsequent wire drawing in order to produce a second or third order superconductor by combination of a first order superconductor (lead) and a normal electrical material (silver). A PbAgBaO-alloy was prepared in the usual metallurgical powder manner, avoiding sucξ influences as considerable differences in densities of the components by melting and solidifying the alloy under zero gravity. The alloy could be drawn to wires some 50 micrometer in diameter because of the use of ductile metals. As a result of the addition of BaO as a dispersion hardening element, the lead could be strain-hardened to such a degree that in-situ deformation of the silver particles was achieved. The small silver particles were finally dispersed with a grain size of less than or equal to 2 micrometer, while the original grain size in the molten body was about 40 micrometer. Despite this, grain size transition from first-order to second-order superconductor could only be observed in the flight sample, with a splitting of the critical magnetic field Hc into a lower field Hc1 and an upper field Hc2.
Author (ESA)

DATA SUMMARY: Some alloys in a mixed state are summarized; variables include atomic percent lead, temperature, altitude, time, particle size, wire diameter; 7 figures and 1 table include numeric data.

N77-14112# National Bureau of Standards, Washington, D.C.
THE METALLURGY EXPERIMENTS ON THE APOLLO-SOYUZ TEST PROJECT (ASTP) **c26**
Elio Passaglia *In* ESA Mater. Sci. in Space Sep. 1976 p 391-400 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The experiments carried out on the mission are described. They included: surface tension induced convection by diffusion in a liquid Pb-PBO.05 at % Au couple (Reed and Adair); oriented growth in LiF-NaCl eutectic (Yue, Yue and Lee); monotectic alloy Pb-Zn and syntectic alloy AlSb (Ang and Lacy); and processing of permanent magnet materials MnBi and (Cu,Co)sCe (Larson). The first experiment was designed to investigate a phenomenon that is more easily studied in space than on the ground; the other three were designed to produce materials of more uniform microstructure by the elimination of buoyancy or convection effects. Results in all cases are preliminary. The Pb-Au experiment was successful. Results indicate a curved solidification interface, but they are not yet complete and so surface-tension-drive convection has yet to be demonstrated. The second experiment produced a more uniform material than ground-based experiments. The Pb-Zn experiment led to discovery of an error in the published phase diagram, while the Al-Sb experiment led to an improved microstructure with less segregation. The Mn-Bi experiment led to material with superior magnetic properties. Each of these experiments is described in detail. Author (ESA)

DATA SUMMARY: Atomic weight percent of bismuth, antimony, and zinc; variables include particle size, coercive force, temperature, distance from cartidge hot end, atomic percent, time; 7 figures include numeric data.

N77-14113# Leitz (Ernst) G.m.b.H., Wetzlar (West Germany).
INTEREST IN SOLIDIFICATION OF GLASSES AND CERAMICS IN SPACE **c27**
K. Deutscher *In* ESA Mater. Sci. in Space Sep. 1976 p 401-404 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The scientific and technological background of the experiment proposals submitted by the German research and development institutes are summarized. These proposals cover the zero-gravity influence on processing in the field of glass and ceramics. ESA

DATA SUMMARY: No numeric data are presented.

N77-14114*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DROP DYNAMICS IN SPACE **c34**
T. G. Wang, M. M. Saffren, and D. D. Elleman *In* ESA Mater. Sci. in Space Sep. 1976 p 405-419 refs Sponsored by NASA (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01 CSCL 20D

Drop experiments proposed for Spacelab are discussed and an acoustic chamber utilizing the torques and forces produced by acoustic waves excited within the chamber is described. Its operation and how it is being tested for experiments is discussed. ESA

N77-14115# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Mechanik.
SHAPING AND DEGASSING OF LIQUEFIED MATTER UNDER SIMULATED LOW AND ZERO GRAVITY **c34**
J. Siekmann *In* ESA Mater. Sci. in Space Sep. 1976 p 421-431 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

Some recent contributions in one field of fluid physics are summarized in connection with the problems of space processing. First, the relative equilibrium shape and the stability of a revolving isolated liquid drop held contained by surface tension and subjected to a uniform electric field parallel to the axis of rotation were examined. A criterion for maintaining perfect sphericity of the relative equilibrium configuration of the drop was formulated. Second, the migration velocity of gas bubbles immersed in a liquid contained between closely spaced parallel plane glass plates and placed in a weak gravitational field was examined experimentally and theoretically. An analogy between the bubble motion in the plate model and the bubbles rising freely through liquid is pointed out. Third, the motion of a shape-preserving gas bubble in a revolving liquid was investigated analytically, experimentally, and numerically. The influence of residual gravity is discussed. It is shown that, due to gravity acting in the plane of bubble motion, the bubble travels in a circle path about the spin axis as seen by an observer moving with the liquid. The importance of this result with respect to degassing of a melt is demonstrated. Author (ESA)

N77-14116# Naples Univ. (Italy). Aerodynamics Inst.
ZEROTH-ORDER BOUNDARY-LAYER THEORIES FOR GAS-MIXTURE FREE-CONVECTION PROBLEMS **c34**
L. G. Napolitano and S. Vetrella *In* ESA Mater. Sci. in Space Sep. 1976 p 433-445 refs (For primary document see N77-14066 05-12)
(Contract CNR-SAS-00100)
Avail: NTIS HC A22/MF A01

To understand reduced-gravity effects on fluid-flow fields, the mathematical modeling of steady laminar, flat plate, free-convection problems involving binary gas mixtures, is reviewed, the ranges of non-dimensional parameters for which the 'classical' theory fails to be applicable are identified and new sets of boundary-layer equations appropriate to these ranges are derived. The approach used is based on a rigorous order-of-magnitude analysis and on the matched asymptotic expansion technique. It is shown that even in condition for which the usual Boussinesq approximation applies, the set of zeroth-order boundary-layer equations can assume different forms according to the orders of magnitude of the Eckert number, the ratio between the nondimensional thermal and concentration driving forces, the ratio between the nondimensional isothermal and isobaric rates of change of density and enthalpy with concentration, and a nondimensional 'transport' parameter combining the thermal diffusion ratio and a measure of the two driving forces. The more relevant features of the new sets of boundary-layer equations are briefly commented upon. Author (ESA)

N77-14117# Kodak Ltd., London (England). Research Div.
CAPILLARY FORCES AND STABILITY IN ZERO-GRAVITY ENVIRONMENTS **c34**
J. F. Padday *In* ESA Mater. Sci. in Space Sep. 1976 p 447-454 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

An attempt is made to describe how the properties of

menisci in zero-gravity environments may be used to estimate the effects of long-range forces between molecules. Capillary forces acting on the surface between two immiscible fluids give rise to a meniscus (i.e. a curved interface) when one of the fluids is of finite volume and supported by a solid surface. The meniscus takes on one of a series of equilibrium shapes which is determined by its supporting solid surface and by the force field acting upon it. The equilibrium meniscus shapes reach theoretically determined properties when conditions of critical stability are attained. Both long range van der Waals forces of the solid and gravitational forces distort the shape of the meniscus and alter its critical equilibrium properties, but the effect of gravity is so very large compared with the force field of the solid on the liquid that the former completely masks the latter in terrestrial experiments - usually by causing drainage. In the absence of gravity, it is shown that certain types of menisci lend themselves to estimating the magnitude and variation of long-range forces. A theoretical approach to an experiment proposed for operation in a zero-gravity environment is evolved. Author (ESA)

N77-14118# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
FLUID DYNAMICS OF THE FLOATING ZONE **c34**
W. Wuest *In* ESA Mater. Sci. in Space Sep. 1976 p 454-465 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

The floating zone technique applied to crystal growth in the absence of gravitational field is described, considering only liquid mobile phases. Four fluid-dynamics aspects are considered in this paper: static stability of cylindrical and noncylindrical melting zones with and without rotation; dynamic stability of rotating or nonrotating floating zones, including plane, longitudinal, torsional, and nonsymmetric oscillations; onset of Marangoni convection due to the temperature dependence of surface tension; and secondary motions due to the presence of electric or magnetic fields. Author (ESA)

N77-14119# Bristol Univ. (England). School of Chemistry.
CAPILLARY INSTABILITIES IN 1 g AND 0g **c34**
J. M. Haynes *In* ESA Mater. Sci. in Space Sep. 1976 p 467-471 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

Capillary hysteresis in the equilibrium behavior of fluids in porous media demonstrates that equilibrium is reached via a thermodynamically irreversible process. Theoretical analysis of a geometrically simple example (in zero-gravity) shows that the irreversibility arises from spontaneous transformations of meniscus shape from positions of metastable equilibrium to others of greater stability. Such instabilities are of fundamental importance in determining fluid behavior, both in porous media, where meniscus curvatures are high and gravity forces unimportant, and in some space-processing operations. The analysis can be extended, by the addition of a gravity-dependent term, to describe the limiting stability of, for example, a drop hanging from an axially-symmetric tip. Although the zero-gravity theory is much simpler, it is still limited to model systems of simple geometry, and the present need is to extend the study to monaxially symmetric interfaces of uniform mean curvature, for which no adequate mathematical method exists. A proposed zero-gravity experiment is described which will provide results allowing fuller understanding of the thermodynamics of fluids in real porous media. Author (ESA)

N77-14120# European Space Agency, Paris (France).
EUROPEAN PROGRAMMES ON SOUNDING-ROCKET AND BALLOON RESEARCH IN THE AURORAL ZONE
Aug. 1976 575 p refs Partly in ENGLISH, and FRENCH; ENGLISH summary Proc. of the 3d ESA/DFVLR Symp. held at Schloss Elmau, West Ger., 3-7 May 1976
(ESA-SP-115) Avail: NTIS HC A24/MF A01

Papers are presented dealing with surveys of national programs, reviews of important problems in physics in the auroral zone, sounding rocket research in the perspective of the Spacelab era, range facilities in northern Europe, active rocket and balloon-borne experiments, cooperative research projects related to EISCAT (European Incoherent Scatter Radar System) and IMS 'International Magnetospheric Study), and technological problems. For individual titles, see N77-14121 through N77-14163.

N77-14121# Kiruna Geophysical Observatory (Sweden).
THE ESA SPECIAL PROJECT CONCERNING THE LAUNCHING OF SOUNDING ROCKETS
B. Hultqvist *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 9-12 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The sounding rocket technique of in situ measuring in near space is reviewed. Results of a study of the ESA Programme Advisory Committee for the Esrange Special Project are outlined, and sounding rocket scientific results are presented. Some future developments, which will include sounding rockets launched from shuttles, are indicated. ESA

N77-14122# Centre National d'Etudes Spatiales, Paris (France).
ROCKETS AND BALLOONS. THE FRENCH PROGRAMME **c15**
G. Weill *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 17-22 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

Tabular account is given of past rocket launchings by CNES, at CNES facilities, or involving French experimenters in cooperative programs. A continuing balloon program is described in terms of types, vehicles, and systems available and being developed, and of research areas of utilization. Author (ESA)

N77-14123# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE GERMAN SCIENTIFIC BALLOON AND SOUNDING-ROCKET PROGRAMME **c15**
D. Joneleit *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 23-30 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The main events in connection with the German scientific balloon and rocket sounding program over the last 1 1/2 years are reviewed, the status of the remaining program is discussed, and an outlook of new programs and ideas is given. ESA

N77-14124# Swedish Space Corp., Stockholm.
THE SWEDISH SOUNDING-ROCKET PROGRAMME 1976-1980 **c15**
P. Zetterquist *In* ESA European Programmes on Sounding-Rocket and Balloon Res. (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01 in the Auroral Zone 1976 p 35-48

The program comprises about five to ten launchings per year from Esrange in northern Sweden. The investigations relate to ionospheric and magnetospheric physics, auroral phenomena, and the upper atmosphere's composition at high latitude. Current trends in the program are increasing payload complexity, for example, mother-daughter payloads, and higher peak altitudes. Most projects are carried out in international cooperation.
Author (ESA)

N77-14125# Appleton Lab., Slough (England).
THE FUTURE BRITISH SOUNDING ROCKET PROGRAMME IN THE AURORAL ZONE **c15**
J. T. Delury *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 49-52 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The approved U.K. sounding rocket program for the years 1976 and 1977 is discussed, and a collaborative scheme for 1978 in the field of D region physics is mentioned. The current U.K. balloon program supports astrophysics. ESA

N77-14126# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
REVIEW OF IMPORTANT PROBLEMS IN PHYSICS OF THE AURORAL ZONE **c46**
G. Pfotzer *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 59-91 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

Phenomena associated with the auroral displays occurring in the relatively narrow belts in high latitudes of both hemispheres

are reviewed. The excitation of the optical emission is caused by the precipitation of magnetospheric particles and their interaction with atmospheric components. Aurora is mainly caused by electrons and protons with energies between about 1 and 10 keV. It is also well established that the most common greenish aurora is excited by electrons. The proton aurora is usually faint or visually undetectible and particularly diffuse. This is mainly due to the interaction of protons with atmospheric components by charge exchange which has the effect that the particles in their intermediate neutral states escape the control of the magnetic field. Author (ESA)

N77-14127# European Space Agency, Paris (France). Space Science Dept.
SOUNDING ROCKET PROGRAMMES IN THE SPACELAB ERA
K. Wilhelm (Max-Planck-Inst. fuer Aeronomie), D. A. Bryant (Appleton Lab.), D. Rees (Univ. Coll., London), B. N. Maehlum (Norweg. Defence Res. Estab., Kjeller), G. Gustafsson (Kiruna Geophys. Inst.), G. Haskell, and A. Pedersen *In its* European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 93-135 In ENGLISH and FRENCH (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The advantages of sounding rockets for the study of the earth environment either as an independent research tool or in combination with related experiments, such as those on satellites or on Spacelab, are presented. The history of sounding rockets up to the International Magnetospheric Study (IMS) is discussed, and scientific problems and vehicle requirements after the IMS are dealt with. Sounding rocket activities after 1984 when Spacelab is in polar orbit are indicated. It is concluded that, although Spacelab can meet some of the experimental requirements of the studies of geophysics and plasma physics currently met by rocket flights from Andoeya and Kiruna, sounding rockets will continue to be needed. Author (ESA)

N77-14128# Swedish Space Corp., Kiruna.
ESRANGE FOR SCIENTIFIC RESEARCH USING SOUNDING ROCKETS AND BALLOONS **c14**
Lars H. Larsson *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 139-166 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

Technical facilities, scientific conditions, launching capabilities, instrumentation, scientific equipment, support facilities, and recovery and use of Esrange, the sounding rocket base in northern Sweden near Kiruna, are described. New facilities added after 1973 are also presented. ESA

N77-14129# Royal Norwegian Council for Scientific and Industrial Research, Blindern.
ANDOEYA ROCKET RANGE **c14**
R. Bjurstroem and A. Gundersen *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 167-174 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The following features of the rocket range in Norway are described: general facilities, telemetry, ballistics, optical site, remote site, launch area, and launch restrictions. ESA

N77-14130# Danish Meteorological Inst., Copenhagen.
SOENDRE STROEMFJORD ROCKET RANGE **c14**
T. StockfletJoergensen *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 175-180 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The following features of the rocket range in Greenland are described: launch restrictions, meteorological conditions, range facilities, and communication. ESA

N77-14131# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
DFVLR. MOBILE ROCKET BASIS, QUO VADIS **c14**
K. Schmidt *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 181-199 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The mobile rocket base Moraba (Mobile Raketenbasis) is discussed. Milestones are mentioned, and the campaigns held so far are reviewed. Ground systems and flight systems are discussed and present projects are dealt with. Moraba will continue with sounding rocket projects, but split into research and applications. These activities will be complemented by balloon launchings. ESA

N77-14132# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany).
FIRST OBSERVATION OF ELECTROSTATIC ACCELERATION OF BARIUM IONS INTO THE MAGNETOSPHERE **c46**
G. Haerendel, E. Rieger, A. Valenzuela, H. Foeppl, H. C. Stenbaek-Nielsen (Univ. of Alaska, College), and E. M. Wescott (Univ. of Alaska, College) *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 203-211 refs (For primary document see N77-14120 05-12) (Grant BMFT-WRK-RV-14-B47/73-SE-20)
Avail: NTIS HC A24/MF A01

Results of the acceleration of barium ions injected to high altitudes in the polar cusp by means of the shaped charge technique are presented. For the first time barium ions were found subject to an appreciable acceleration by potentials along the magnetic lines of force. In one case, the potential was 200 V, in the other, above an auroral arc, it was several kV. Although such potentials at altitudes of many 1000 km have been postulated many times as a result of studies of auroral particles, it was found that indeed the same process acts on cold injected ions. Author (ESA)

N77-14133# Norwegian Defence Research Establishment, Kjeller.
POLAR 5, NORWEGIAN/US ELECTRON ACCELERATOR SOUNDING ROCKET **c46**
T. A. Jacobsen, B. N. Maehlum, and J. Troeim *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 213-220 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

A technical description of a mother daughter experiment including an electron gun is given. The payload was launched by a Nike/Tomahawk rocket from Andenes, North-Norway near 2030 local time on February 1, 1976. A few preliminary observations obtained by the HF-wave propagation experiment, the retarding potential analyzer and the energetic electron counters are presented. Author (ESA)

N77-14134# European Space Research and Technology Center, Noordwijk (Netherlands).
PLASMA DIAGNOSTIC AND WAVE DETECTION WITH ELECTRON EMITTERS **c46**
R. Grard *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 221-226 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The use of electron sources to control the potential of spacecraft and rockets is discussed. The net current received by the vehicle is returned to the ambient medium through a cathode and can therefore be measured; the collecting body can then play the role of a Langmuir probe with a very large collecting area. It is proposed to detect electromagnetic and electrostatic waves with the same system by measuring the associated current fluctuations. Author (ESA)

N77-14135# Mullard Space Science Lab., Dorking (England).
SUPERTHERMAL ELECTRON FLUXES DURING VARIOUS PHASES OF AURORAL SUBSTORMS **c46**
J. J. Sojka, W. J. Raitt, and A. D. Johnstone *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 227-240 refs Sponsored by Sci. Res. Council (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

Upper atmosphere measurements of superthermal electrons were made; they were related to the basic collision cross sections of the primary particles. It is shown that the superthermal electrons behave as dynamically as the more energetic electrons in developing field aligned pitch angle distributions and energy

peaks deep in the atmosphere. The implication is that the parallel electric field which accelerates the electron acts on the particles concurrently with atmospheric scattering. ESA

N77-14136# Bergen Univ. (Norway).
ROCKET MEASUREMENTS OF X-RAYS AND ENERGETIC ELECTRONS THROUGH AN AURORAL ARC c46
K. Aarsnes, J. Stadsnes, and F. Soeraas *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 241-249 refs Sponsored by Roy. Norweg. Council for Sci. and Ind. Res. (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The spatial structure and time and space variations in the primary electron fluxes in the auroral arc are discussed, using Polar 5 rocket sounding measurements. A good correspondence between the X ray and electron data was found. By using a well colimated detector on a spinning rocket it was possible to get additional information on the overall electron precipitation pattern. ESA

N77-14137# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany).
CO-ORDINATED MEASUREMENTS WITH EISCAT, SOUNDING ROCKETS AND BALLOONS AIMED AT PLASMA-PHYSICAL STUDIES c46
G. Haerendel *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 253-262 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

Possible rocket and balloon soundings with Eiscat, European incoherent scatter radar system, envisaged to be operational in 1978, are presented. Topics dealt with include Thomson scatter probing above 1,000 km and coordinated balloon-borne observations. ESA

N77-14138# Appleton Lab., Slough (England).
TRANSATLANTIC BALLOON FACILITY c01
J. T. Delury, G. W. Luscombe, D. Ramsden (Southampton Univ.), and R. E. Baker (Southampton Univ.) *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 265-278 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

Long duration balloon flights from Sicily to the U.S. are dealt with, and the wind pattern at 30 to 42 km altitude at 37 deg N latitude during June, July and August is described. Estimated float durations and termination points in the U.S. are listed with details of the necessary ballast drops to maintain float heights. The effect of cloud cover and estimates of the scientific payload capability of a 20 M.C.F. as a function of flight duration are discussed. The U.K. experience of the successful 1975 validation flight and the technical problems tackled are dealt with, and the 1976 proposed flight program is presented. The Transatlantic Balloon Facility is being developed by the U.K. in cooperation with other European countries with assistance from NCAR. Author (ESA)

N77-14139# Centre National d'Etudes Spatiales, Toulouse (France).
THE USE OF FRENCH BALLOONS FOR SCIENTIFIC RESEARCH [LES BALLONS FRANCAIS AU SERVICE DE LA RECHERCHE SCIENTIFIQUE] c01
A. Soubrier *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 279-281 In FRENCH (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The chief aspects of the use of balloons for scientific research, particularly during the last five years, are reviewed and principal ways of future development are indicated. Stratospheric balloon flights constituted the main line of action: 470 flights for 39 laboratories in Western Europe. Development of balloon material, such as a 20 to 25 micron polyethylene fiber for stratospheric balloons, a 20 to 100 micron polyester film for pressurized balloons, and composite material for pressurized balloons for high altitudes and payloads from 10 to 600 kg, are discussed. The Argos balloon localization and data collection system to be implemented on the Tiros N satellite is also discussed. ESA

N77-14140# Winzen Research, Inc., South St. Paul, Minn.
PROGRESS IN SCIENTIFIC BALLOON TECHNOLOGY c02
Otto Winzen *In* ESA European Programmes on Sounding-Rocket and Ballloon Res. in the Auroral Zone 1976 p 283-293 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The development of scientific balloons at Winzen Research Inc. over the last 30 yr is discussed. Balloons have been constructed for altitudes from 30 to 52 km, loads from 30 to 4,000 kg, flight duration from 8 to 120 hrs, volume from 6,000 to 2,000,000 cbm, and reliability from 50 to 96.6%. A record breaking flight altitude of 55,000 m was quoted. ESA

DATA SUMMARY: Performance characteristics of balloon flights since 1972; variables include balloon size, flight duration, flight altitudes, weight of suspended load; 2 figures and 2 tables include numeric data.

N77-14141# Marconi Space and Defence Systems Ltd., Camberley (England).
THE DEVELOPMENT AND PERFORMANCE OF THE MSDS STABILISED BALLOON PLATFORM c02
J. How *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 295-306 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

Manufacture and development of a general purpose stabilized balloon platform are discussed. The platform, now being integrated with initial experiments, stabilizes in three axes and can be operated in two modes. Coarse control to degree accuracy will acquire and stabilize to any accessible part of the celestial sphere under telecommand. Fine control is achieved with the star sensor locking on to a target star, an offset facility being included for non-visible observations. The platform is of modular construction around a central gimbal module allowing considerable build flexibility. The system relies on rate gyroscopes for primary stabilization with linear accelerometers, magnetometers, and a star sensor for positional information. A slow scan video system is included for pointing verifications. Author (ESA)

DATA SUMMARY: Minute mode performance test results at 70 deg. elevation; variables include time, X elevated star error, elevated star error; 1 figure includes numeric data.

N77-14142# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
SPEKTROSTRATOSKOP: A STABILISED BALLOON GONDOLA c02
K. Ernsberger, B. Koesters, H. Meier, and D. Schnebel *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone. 1976 p 307-312 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

Design features of the attitude control system of Spektrostratoskop, a balloon-borne solar telescope, are described. The high optical resolution of the experiment (0.3 arcsec) requires attitude stability of the same order. The achieved attitude stability of less than 0.3 arcsec in flight is shown by telemetry signals. The attitude control is achieved in two stages: a coarse stage involving a sun sensor and a DC-torquer and a fine pointing stage. Author (ESA)

DATA SUMMARY: In-flight and ground test measurements of altitude stability of a stablized balloon gondola; variables include pitch angle (gondola) pitch angle (telescope) pitch torquer voltage, roll telescope gondola relative angle, roll angle telescope (gyro signal) pitch angle (sun sensor signal), pointing accuracy of altitude control system; 3 figures include numeric data.

N77-14143# European Space Research and Technology Center, Noordwijk (Netherlands).
SITUATION REPORT ON GEOS c15
K. Knott *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 315-322 (For primary document see N77-14120 05-12)

Avail: NTIS HC A24/MF A01

The status of the GEOS project is reviewed with emphasis on program planning (launch date envisaged is 15 April 1977), longitudinal shift plan, and data handling system. The GEOS payload consists of seven experiments, four of which measure particles and the other three measure fields. Particle energy coverage stretches from thermal energies up to several 100 keV for electrons and up to several MeV for protons. Particles with higher mass numbers, up to 140 amu, are covered to about 20 keV. GEOS wave experiments have a frequency range of 77 kHz for electric fields and of 30 kHz for magnetic fields. ESA

N77-14144# European Space Research and Technology Center, Noordwijk (Netherlands).

DEVELOPMENT REPORT ON THE ISEE MISSION c15

A. C. Durney *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 323-333 (For primary document see N77-14120 05-12)

Avail: NTIS HC A24/MF A01

The status of the International Sun-Earth Explorer (ISEE) project, a cooperative effort by NASA and ESA, consisting of a pair of spacecraft, A and B, with carefully matched payloads to be launched in tandem into the same highly eccentric orbit, is reviewed. The third spacecraft, ISEE-C, will sit permanently in the solar wind. Topics such as neutral sheet crossing time predictions, data processing, and status of the project are dealt with. ESA

N77-14145# Secretariat Committee for Coordination of Observations, Uppsala (Sweden).

SHORT REPORT FROM CCOG, COMMITTEE FOR COORDINATION OF GROUND-BASED OBSERVATIONS ASSOCIATED WITH GEOS c14

W. Stoffregen *In* ESA European Programmes on sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 335-338 (For primary document see N77-14120 05-12)

Avail: NTIS HC A24/MF A01

During the International Magnetospheric Study, which started January 1, 1976, a great number of observations will be done from the ground, and single instruments as networks of instruments are in operation. The duty of the CCOG was to disseminate information on ground based research and to coordinate the operations. ESA

N77-14146# Observatoire de Paris-Meudon (France).

THE SCHEME OF SELF COORDINATION TENTATIVELY SET UP BY THE IMS STEERING COMMITTEE c46

P. Simon *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 339-342 (For primary document see N77-14120 05-12)

Avail: NTIS HC A24/MF A01

Coordination activities of the International Magnetospheric Study Steering Committee are presented. Two main mechanisms were established: the Satellite Situation Center at the Goddard Space Flight Center and the IMS Central Information Office (CIO) at Boulder. The aim of the CIO is to establish a link between all IMS experiments published in the IMS newsletter. Experimenters are asked to fill in a standardized form for the announcement of an IMS project. In addition to CIO there is a European Office at Meudon Observatory, France, and a U.S.S.R. office at Izmiran near Moscow. There are other national offices in the U.K., Japan, Australia, Canada, and the U.S. ESA

N77-14147# Liege Univ. (Belgium).

THE E1 EXPERIMENT ABOARD S 22 PAYLOAD: CAPABILITIES OF THE PROTOTYPE MODEL c15

J. Jamar, J. P. Macau, R. Duysinx, M. Henrist, and A. Monfils *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 343-349 (For primary document see N77-14120 05-12)

Avail: NTIS HC A24/MF A01

The development of a crossed dispersion ultraviolet spectrometer incorporating microchannel plate intensifiers for the Swedish Space Corporation S22 rocket sounding payload is presented. ESA

N77-14148# Liege Univ. (Belgium).

SOME RECENT RESULTS ON THE AURORAL ATMOSPHERE DURING THE BREAKUP PHASE c46

R. Duysinx and M. Henrist *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 351-358 refs (For primary document see N77-14120 05-12)

Avail: NTIS HC A24/MF A01

Sounding rocket polychromator ultraviolet and visible light data obtained on board the ESRO payloads C78/1 and C78/2 launched in 1971 are presented. Some particularly interesting observations on the intensity of the N2 second positive system (2P), the concentration of atomic oxygen, and the hydrogen auroral emissions are discussed. ESA

N77-14149# Southampton Univ. (England).

DIRECTION FINDING STUDIES OF WHISTLER MODE SIGNALS: SOME CAMPAIGNS FUNDED FOR THE IMS c46

M. J. Rycroft *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 359-369 refs (For primary document see N77-14120 05-12)

Avail: NTIS HC A24/MF A01

The method of using two or more direction finding (geniometer) receivers to locate, by triangulation, the regions where whistler mode signals emerge from the ionosphere into the earth-ionosphere waveguide is reviewed. Some observations are reported of a recent campaign, funded by the U.S. NSF, conducted in eastern Canada. The aims of, and plans for, conducting further similar experiments during the International Magnetospheric Study are discussed. Funds have already been granted by the U.K. SRC to conduct campaigns in conjunction with active magnetospheric experiments, such as barium shaped charge releases and man-made whistler mode transmissions, and with GEOS, in both the Scandinavian and Icelandic meridians. Author (ESA)

N77-14150# Bergen Univ. (Norway).

MEASUREMENTS OF AURORAL-ZONE PHENOMENA BY A VERSATILE BALLOON-BORNE PAYLOAD c46

J. Bjordal, K. Broenstad, T. E. Moe, J. Stadsnes, S. Ullaland, A. Egeland (Oslo Univ.), N. Karlsen (Oslo Univ.), and E. Thrane (Norweg. Defence Res. Estab., Kjeller) *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 371-385 refs Original contains color illustrations (For primary document see N77-14120 05-12)

Avail: NTIS HC A24/MF A01

A multi-experiment balloon payload, which includes seven directional X-ray detectors for mapping of the spatial and temporal distribution of precipitating electrons, measurements of the geomagnetic field, electric fields, VLF waves, and of pressure and temperature for detection of infrasonic waves is described. Preliminary results from a flight test in the conjugate area of the ATS 6 satellite are presented. The main experiment will be performed during the IMS-period with simultaneous conjugate measurements on the GEOS satellite. Author (ESA)

N77-14151# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).

A PROPOSED METHOD FOR THE DIRECT MEASUREMENT OF ENHANCED RESISTIVITY c46

L. R. O. Storey and M. Malingre *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 387-409 refs (For primary document see N77-14120 05-12)

Avail: NTIS HC A24/MF A01

Observations of electric fields in the auroral ionosphere (F region), with components of the order of 10 mV/m parallel to the earth's magnetic field, were explained in terms of enhancement of the parallel resistivity by plasma turbulence; enhancement factors of at least 10,000 are required to explain the observations. Qualitative arguments show that, if the resistivity is enhanced to this extent, it should be directly measurable by means of a rocket-borne quadrupole probe working at a frequency of about 500 Hz. An experiment of this type is planned for Jan. 1978. Author (ESA)

N77-14152# European Space Research and Technology Center, Noordwijk (Netherlands).

PROPOSED HIGH ALTITUDE RESONANCE CONE AND PARAMETRIC DECAY EXPERIMENT c46

R. W. Boswell, G. Ventura (Florence Univ.), and G. Martelli (Sussex Univ.) *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 411-419 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

An experiment to investigate fundamental nonlinear interactions between a large amplitude wave and the magnetoplasma, using a monochromatic whistler mode wave of a single frequency launched by a loop antenna, is proposed. ESA

N77-14153# Sheffield Univ. (England).
CO-ORDINATED ROCKET AND GROUND-BASED STUDIES OF THE STRUCTURE AND DYNAMICS OF THE LOWER THERMOSPHERE **c46**
W. Gibbons, T. R. Kaiser, S. P. Kingsley, H. G. Muller, and L. J. C. Woolliscroft *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 421-432 refs Sponsored by Sci. Res. Council (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

Ground-based meteor wind radar and rocket-borne techniques for studying the lower thermosphere are presented. It is shown that comparisons between meteor radar observations and other measurements of neutral winds in the lower E-region can exhibit good agreement provided that the observations are made simultaneously and in a common volume of atmosphere and that certain restrictions are applied to the time and space over which the meteor radar data are averaged. A meteor radar vertical wind profile, obtained under these conditions, has shown an interesting correlation with an electron density profile measured during a Petrel rocket flight. Such coordinated aeronomic studies are likely to increase our understanding of the physical and chemical processes which take place in the lower atmosphere. Author (ESA)

N77-14154# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
TEXUS: A SPACELAB PREPARATORY PROGRAM FOR TECHNOLOGICAL EXPERIMENTS IN SOUNDING ROCKETS
H. S. Anton and H. Schreiber *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 435-438 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The Texus (Technological Experiments Under Absence of Gravity) program is presented schematically. Objectives of Texus, of which the first launch is planned for end 1977 followed by two launches per year until 1981, are to increase the knowledge of materials and processes by experiments performed under zero gravity and to optimize the use of Spacelab from the scientific and cost effectiveness points of view. ESA

N77-14155# British Aircraft Corp. (Operating) Ltd., Bristol (England).
RECENT ADDITIONS TO THE SKYLARK FAMILY OF SOUNDING ROCKETS **c15**
D. J. Brown *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 439-453 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

Skylark vehicle developments over the last 2 to 3 years that enabled a wide range of sounding rockets to be added to the Skylark family of sounding rockets are reviewed. The new range of vehicles are designated Skylark 10A, 7, 12, and 9, and they cater for payloads ranging from 0.26 m to 1.2 m approx. diameter and 50 kg to 1000 kg mass. They are particularly suitable for carrying out geophysical experiments in the auroral zone. Author (ESA)

N77-14156# British Aircraft Corp. (Operating) Ltd., Bristol (England).
FREE SPACE MOTION OF THE SKYLARK 12 SOUNDING ROCKET **c15**
W. Johnson *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 455-472 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The effect of various disturbances on the motion of a prolate rocket in vacuum is considered. The results were applied to a Skylark 12 sounding rocket to determine probability distributions for the magnitude of its coning motion and the position of its coning axis. These distributions indicate that just before the first experimental event occurs the one sigma value for the angle between the coning axis and the nominal velocity vector at 70 km is 5.7 deg and the one sigma value for the semi-cone angle is 3.6 deg. The results can then be used by experimenters to optimize the alignment of their experiments. Author (ESA)

N77-14157# Bristol Aerospace, Ltd., Winnipeg (Manitoba).
NIKE-BLACK BRANT 5C AND XM-75 TWO QUALIFIED SOUNDING ROCKETS FOR THE USER WITH VERY HEAVY PAYLOADS OR VERY LIGHT PAYLOADS **c15**
J. R. Bevis *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 473-483 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

Developments of the 5 kg payload Black Brant 6/XM-75 and 500 kg payload Nike-Black Brant 5C sounding rockets are described. These two rockets represent the extremes in a family of Black Brants that encompass virtually the entire altitude/payload weight envelope of interest to the scientist who employs sounding rockets. ESA

N77-14158# Bristol Aerojet, Ltd., Banwell (England).
PETREL 3 AND SKUA 4: EARTH RESOURCES SURVEY ROCKETS **c15**
S. J. Pooley *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 485-495 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The possibility of using, for the survey of earth resources, relatively small and inexpensive sounding rockets having a low and predictable impact dispersion is reviewed. Petrel 3 can carry an attitude control unit, and a system is proposed that is used in conjunction with a 70 mm camera fitted with a 800 mm scanning lens. With this payload Petrel is capable of reaching a maximum altitude of 140 km. The rocket will be stabilized for camera operation for 225 sec above 80 km altitude, during which it travels 26 km in range. This distance may be increased to about 75 km by launching at a lower angle. The Skua 4 aims a camera from a height of about 80 km. The camera after being separated from the rocket will take photographs while pointed towards the ground by a high altitude parachute. The Skua 4, with its exceptionally low dispersion, would provide a simple, effective, and inexpensive means of studying earth resources. Author (ESA)

N77-14159# Swedish Space Corp., Solna.
DEVELOPMENT OF THE S19 GUIDANCE SYSTEM FOR THE REDUCTION OF SOUNDING ROCKET DISPERSION **c15**
L. Anderson and J. Andersson (Saab-Scania, Linkoeping, Swed.) *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 497-511 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The development of the system for control of sounding rockets during the boost phase is described. The guidance system consists of a self-energized payload module, easily adaptable to different rockets, with two pairs of canards for aerodynamic control. The vehicle lateral attitude is kept constant during the first ten sec of flight, resulting in a considerably reduced impact error. The main contributions to impact dispersion, caused by wind error and thrust misalignment, are reduced by a factor of up to ten depending on the corresponding unguided case. The first test flight in January 1976 at NASA Wallops Flight Center was made successfully with a Black Brant VC rocket. Author (ESA)

N77-14160# Societe d'Applications Generales d'Electricite et de Mecanique, Paris (France).
INERTIAL UNITS FOR ATTITUDE CONTROL OF PROBE ROCKETS **c15**
M. G. Monier *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 513-524 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

A Cassiopee attitude control system used for the payload of Faust astronomical rockets is described. It is a typical example of inertial system utilization on probe rockets. The Cassiopee system includes a gimballed type, inertial attitude reference unit and a strapped down type fine inertial sensor used to provide stabilization around a fixed direction. In both these units, the inertial sensor is a Sagem F type ingrating gyro. The flight tests carried out in 1974 and 1975 were successful. The equipment which, from 1977 onwards, will replace the Cassiopee inertial elements, will be highly miniaturized.
Author (ESA)

N77-14161# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
DEVELOPMENT TRENDS IN PAYLOAD CONTROL SYSTEMS **c15**
John J. Turner *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 529-540 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

Some recent trends in extraterrestrial research vehicle payload control are discussed and the activities of the Mobile Raketenbasis in this field are presented. Sounding rockets control system design criteria, sensors, and control processing are dealt with. The Three Axes Rate Control System of the Texus zero gravity program is discussed and the Miniature One Axis Control System for sounding balloons is described. ESA

N77-14162# Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejon de Ardoz (Spain).
FLAMENCO SOUNDING ROCKET **c15**
J. Simon, A. Mateo, and M. Vazquez *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 541-549 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The Flamenco system developed by the Spanish government is described. Results of flight trials are incorporated in the general performance data presented. Mechanical details of the two-stage rocket include strong spin motors and alternative dwell times between the stages. Two further launches carrying scientific payloads are scheduled for late 1976. Author (ESA)

N77-14163# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
A LOOK AT THE FUTURE REQUIREMENTS FOR TELEMETRY DATA TRANSMISSION IN SOUNDING ROCKET AND BALLOON PROJECTS **c17**
G. Mayer and G. E. Todd *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 551-556 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

The increase of telemetry data capacity for future space research projects is reviewed, based on the requirements of all main national projects since 1966. The data capacity developed to its present form is discussed and the limits imposed and some likely solutions to the resulting problems are examined. Trends and future needs are also considered. The scientific community is recommended to use the L and S bands.
Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N77-14164*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSFORMATION FROM PROPER TIME ON EARTH TO COORDINATE TIME IN SOLAR SYSTEM BARYCENTRIC SPACE-TIME FRAME OF REFERENCE
Theodore D. Moyer 1 Dec. 1976 72 p refs
(Contract NAS7-100)
(NASA-CR-149276; JPL-TM-33-786) Avail: NTIS HC A04/MF A01 CSCL 22A

An expression was derived for the time transformation t - tau, where t is coordinate time in the solar system barycentric space-time frame of reference and tau is proper time obtained from a fixed atomic clock on earth. This transformation is suitable for use in the computation of high-precision earth-based range and Doppler observables of a spacecraft or celestial body located anywhere in the solar system; it can also be used in obtaining computed values of very long baseline interferometry data types. The formulation for computing range and Doppler observables, which is an explicit function of the transformation t - tau, is described briefly. Author

N77-14165# Sandia Labs., Albuquerque, N.Mex.
AUTOMATED SCHEME TO DETERMINE DESIGN PARAMETERS FOR A RECOVERABLE REENTRY VEHICLE
W. E. Williamson 1976 7 p refs Presented at AIAA Atmospheric Flight Mechanics Conf., Dallas, 7 Jun. 1976 Sponsored by ERDA
(SAND-76-5358; Conf-760606-1) Avail: NTIS HC A02/MF A01

The NRV (Nosetip Recovery Vehicle) program is designed to recover the nose section from a sphere cone reentry vehicle after it has flown a near ICBM reentry trajectory. Both mass jettison and parachutes are used to reduce the velocity of the RV near the end of the trajectory to a sufficiently low level that the vehicle may land intact. The design problem of determining mass jettison time and parachute deployment time in order to ensure that the vehicle does land intact is considered. The problem is formulated as a min-max optimization problem where the design parameters are selected to minimize the maximum possible deviation in the design criteria due to uncertainties in the system. The results indicate that the optimal choice of the design parameters ensures that the maximum deviation in the design criteria is within acceptable bounds. This analytically ensures the feasibility of recovery for NRV. ERA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N77-14166# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
THE MOST IMPORTANT SUBSYSTEMS OF THE HELIOS COMMAND STATION AT WEILHEIM-LICHTENAU
Bonn Bundesmin. fuer Forsch. u. Technol. Apr. 1976 151 p refs In GERMAN; ENGLISH summary Proc. of a Tech.-Sci. Colloq. held at Weilheim-Lichtenau, West Ger., 20 Mar. 1975 (Contract BMFT-WRF-4048)
(BMFT-FB-W-76-04) Avail: NTIS HC A08/MF A01; ZLDI, Munich DM 31,30

On 20 March 1975 the Helios Command Station at Lichtenau near Weilheim was offically handed over by the Institute for Avionics and Microwaves, who constructed it, to the operators, the German Space Operations Centre, both institutions of the DFVLR. Scientists and engineers of the DFVLR and various firms responsible for subsystems read papers on the following topics: computer control of the station; command modulator unit; control transmitter and monitoring receiver; S-band transmitter output stage; 30 m parabolic antenna-design, construction, electrical characteristics, rotating stage drive; and the Loran C system. For individual titles, see N77-14167 through N77-14175.

N77-14167# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
THE COMMAND STATION FOR THE HELIOS SOLAR PROBE. INTRODUCTION AND REVIEW [DIE KOMMANDOSTATION FUER DIE SONNENSONDE HELIOS. EINFUEHRUNG UND UEBERSICHT]
H. Oettl *In its* The Most Important Subsystems of the Helios Command Sta. refs In GERMAN (For primary document see

N77-14166 05-14)
Avail: NTIS HC A08/MF A01; ZLDI, Munich DM 31,30 at Weilheim-Lichtenau Apr. 1976 p 7-22

The Helios telecommand station at Weilheim-Lichtenau, Germany, is described. A review of the communication equipment is given and the functioning of the station is described using a simplified block diagram. Members of the project team are presented. ESA

N77-14168# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.

COMPUTER CONTROL OF THE HELIOS COMMAND STATION (GTS) [RECHNERSTEUERUNG DER HELIOS-KOMMANDOSTATION (GTS)]

H.-J. Katerle and W. Fels (Control Data Corp., Munich) *In its* The Most Important Subsystems of the HELIOS Command Sta. at Weilheim-Lichtenau Apr. 1976 p 23-32 refs In GERMAN (For primary document see N77-14166 05-14)
Avail: NTIS HC A08/MF A01; ZLDI, Munich DM 31,30

Hardware components such as the antenna control system, the command modulator unit, and the S-band control transmitter, as well as the functional relationships of these components of the Helios ground station at Weilheim-Lichtenau, Germany, are discussed. The computer system consists essentially of two parallel CDC 1700 SC computers, two CD 1739 mass storage devices, two data channels 1706/1 and 1706/2, and three control units GPI 1749, UPI 1750/1, and UPI 1750/2. The software system is based on the CDC MSOS 3.0 operating system. ESA

N77-14169# AEG-Telefunken, Ulm (West Germany).

THE COMMAND MODULATOR UNIT OF THE HELIOS COMMAND STATION [DIE KOMMANDO-MODULATOR-EINHEIT DER HELIOS-KOMMANDOSTATION]

J. Koch *In* DFVLR The Most Important Subsystems of the Helios Command Sta. at Weilheim-Lichtenau Apr. 1976 p 33-39 In GERMAN (For primary document see N77-14166 05-14)
Avail: NTIS HC A08/MF A01; ZLDI, Munich DM 31,30

The telecommand modulator unit at Weilheim-Lichtenau, Germany, developed for space probes and interplanetary spacecraft, is detailed. The electrical and mechanical components are discussed, and measures to achieve higher precision, notably of the carrier signal frequency and of the modulated output signal, are presented. Some technical data are: carrier frequency range 80 Hz to 110 kHz; frequency constant of the internal quartz oscillator smaller than 2 x 10 to the minus 8th power; Klirr factor smaller than 1%; tilt smaller than 2%; and frequency range 100 Hz to 100 kHz plus or minus 0.2%. ESA

N77-14170# Siemens A.G., Munich (West Germany).

CONTROL TRANSMITTER AND MONITORING RECEIVER OF THE HELIOS COMMAND STATION [STEUERSENDER UND KONTROLLEMPFAENGER DER HELIOS-KOMMANDOSTATION]

E. Lampert *In* DFVLR The Most Important Subsystems of the Helios Command Sta. at Weilheim-Lichtenau Apr. 1976 p 40-58 refs In GERMAN (For primary document see N77-14166 05-14)
Avail: NTIS HC A08/MF A01; ZLDI, Munich DM 31,30

The functioning of the control transmitter and monitoring receiver at Weilheim-Lichtenau, Germany, is described. The control transmitter generates the phase modulated S-band telecommand signal with which the power transmitter is controlled. To this end a data modulator carrier signal with preselected amplitude is received from the command modulator, which phase modulates a ZF-signal. Frequency multiplication then produces the S-band signal. The control transmitter has a large bandwidth, a high linearity of the modulation gradient, and a large short term and long term phase stability. The S-band telecommand signals are controlled by a receiver, the fundamental set up of which is also described. ESA

N77-14171# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

S-BAND TRANSMITTER OUTPUT STAGE FOR THE HELIOS COMMAND STATION LICHTENAU [S-BAND SENDEREND-STUFE FUER DIE HELIOS-KOMMANDOSTATION LICHTENAU]

H. Kroder *In* DFVLR The Most Important Subsystems of the Helios Command Sta. at Weilheim-Lichtenau Apr. 1976 p 59-77 In GERMAN (For primary document see N77-14166 05-14)
Avail: NTIS HC A08/MF A01; ZLDI, Munich DM 31,30

The requirements for the S-band transmitter output stage of the Helios command station at Weilheim-Lichtenau, Germany, are discussed. Topics dealt with include components specifications, S-band power stage, klystron power supply, klystron cooling, transmitter output stage central command and control unit, and universal polarizer. ESA

N77-14172# Krupp (Fried.) G.m.b.H., Rheinhausen (West Germany).

30 m PARABOLIC ANTENNA. CALCULATION, CONSTRUCTION AND EXECUTION OF THE MECHANICAL PART [30-m-PARABOLANTENNE - BERECHNUNG, KONSTRUKTION UND AUSFUEHRUNG DES MECHANISCHEN TEILS]

H. Eschenauer *In* DFVLR The Most Important Subsystems of the Helios Command Sta. at Weilheim-Lichtenau Apr. 1976 p 78-96 refs In GERMAN (For primary document see N77-14166 05-14)
Avail: NTIS HC A08/MF A01; ZLDI, Munich DM 31,30

The 30 m parabolic antenna of the Helios ground station at Weilheim-Lichtenau, Germany, is described. The following requirements had to be fulfilled: command and control of the Helios probe up to 2 Au, compatible with DSN (bandwidth 2.11 to 2.12 GHz), mission independent, S-band receiving, and automatic probe tracking, ranging, and operating at higher frequencies up to 11 GHz. Constructional components, such as the rigid and rotable azimuth part and the elevation part, as well as the manufacturing aspects, are dealt with. An evaluation was made of the precision reached and it is shown that the measured values are well within specifications. ESA

N77-14173# Siemens A.G., Erlangen (West Germany).

ROTATING STAGE DRIVE AND CONTROL [ANTRIEBE UND REGELUNG DES DREHSTANDS]

I. Neuffer *In* DFVLR The Most Important Subsystems of the Helios Command Sta. at Weilheim-Lichtenau Apr. 1976 p 97-104 In GERMAN (For primary document see N77-14166 05-14)
Avail: NTIS HC A08/MF A01; ZLDI, Munich DM 31,30

Unlike American antennas, which for the most part are moved by hydraulic drives, direct current motors were used for the Helios ground station antenna at Weilheim-Lichtenau, Germany. The performance of these motors is 12 kW; two motors are used for the elevation and four motors for the azimuth. For position and rotation speed detection so-called measuring machines, consisting of a Rund-INDUCTOSYN transmitter connected to the SINUMERIK 500 control system, are used. The antenna can be driven automatically or manually. Position control of the antenna can be accomplished by means of a command variable detector or by cascade control. ESA

N77-14174# Siemens A.G., Munich (West Germany).

ELECTRICAL DEVELOPMENT OF THE HELIOS COMMAND STATION NEAR WEILHEIM [ELEKTRISCHE ENTWICKLUNG DER 30-m-ANTENNE DER HELIOS-KOMMANDOSTATION BEI WEILHEIM]

W. Rebhan, H. Thiere, and U. Leupelt *In* DFVLR The Most Important Subsystems of the Helios Command Sta. at Weilheim-Lichtenau Apr. 1976 p 105-143 refs In GERMAN (For primary document see N77-14166 05-14)
Avail: NTIS HC A08/MF A01; ZLDI, Munich DM 31,30

The Helios ground station antenna at Weilheim-Lichtenau was developed such that a gain of at least 52 dB can be reached, whereas in the horizontal plane a sweep radiation attenuation of only some dB more would be permissible. On scale models it was shown that gains of 52.9 to 53.6 are possible. The electrical principle of the Helios antenna is discussed and investigations on a 3 m parabolic mirror are detailed. The reflector contours were calculated, and near field measurements on a horn parabole exciter model are presented. Sweep field measurements on a reception reflector model are given, and aperture field and far field measurements on a 2 m model of the Helios antenna are discussed. Finally symmetrization of the excitation field, by excitation of the E11-wave, is dealt with. ESA

N77-14175# Oscilloquartz S.A., Neuchatel (Switzerland).
CESIUM FREQUENCY AND TIME NORMAL LORAN-C RECEPTION [CAESIUMFREQUENZ- UND ZEITNORMAL LORAN-C-EMPFANG]
R. Loup *In* DFVLR The Most Important Subsystems of the HELIOS Command Sta. at Weilheim-Lichtenau Apr. 1976 p 144-149 In GERMAN (For primary document see N77-14166 05-14)
Avail: NTIS

The cesium 133 frequency standard model B-5000 of oscilloquartz was modified so that two quartz oscillators are available. The 100 kHz frequency is used for the Loran-C reception system, developed by the MIT Radiation Laboratory; the system is described in detail. ESA

N77-14176# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Ground Equipment/ Materials Directorate.
THE 2.75 ROCKET LAUNCHER ICE PROTECTION TESTS Technical Report, Dec. 1975 - Feb. 1976
Donald Davis 18 Mar. 1976 34 p
(DA Proj. 1E2-64202-D-162)
(AD-A027660; RL-76-13) Avail: NTIS HC A03/MF A01 CSCL 19/7

A series of 2.75-inch icing test firings was carried out at US Army Missile Command, Redstone Arsenal, Alabama during the winter of 1975-1976. The existence of a launcher icing problem was verified. Several passive protection devices were tested. A final solution was not found, but the ground-work for future efforts was laid. Author (GRA)

N77-14045*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Dec. 1976 p 1-3 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N77-14046*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN GROUND COMMUNICATIONS FACILITY
M. S. Glenn *In its* The Deep Space Network 15 Dec. 1976 p 4-12 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N77-14047*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING MISSION SUPPORT
D. W. Johnston and T. Howe *In its* The Deep Space Network 15 Dec. 1976 p 13-21 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 22D

N77-14048*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT
R. B. Miller *In its* The Deep Space Network 15 Dec. 1976 p 22-27 ref (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 22D

N77-14049*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT
P. S. Goodwin, E. S. Burke, and R. E. Morris *In its* The Deep Space Network 15 Dec. 1976 p 28-34 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 22D

N77-14064*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN RESEARCH AND TECHNOLOGY SUPPORT
E. B. Jackson *In its* The Deep Space Network 15 Dec. 1976 p 153-156 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N77-14128# Swedish Space Corp., Kiruna.
ESRANGE FOR SCIENTIFIC RESEARCH USING SOUNDING ROCKETS AND BALLOONS
Lars H. Larsson *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 139-166 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14129# Royal Norwegian Council for Scientific and Industrial Research, Blindern.
ANDOEYA ROCKET RANGE
R. Bjurstroem and A. Gundersen *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 167-174 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14130# Danish Meteorological Inst., Copenhagen.
SOENDRE STROEMFJORD ROCKET RANGE
T. StockfletJoergensen *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 175-180 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14131# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
DFVLR. MOBILE ROCKET BASIS, QUO VADIS
K. Schmidt *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 181-199 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14145# Secretariat Committee for Coordination of Observations, Uppsala (Sweden).
SHORT REPORT FROM CCOG, COMMITTEE FOR CO-ORDINATION OF GROUND-BASED OBSERVATIONS ASSOCIATED WITH GEOS
W. Stoffregen *In* ESA European Programmes on sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 335-338 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N77-14177*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA/ESA CT-990 SPACELAB SIMULATION. APPENDIX A: THE EXPERIMENT OPERATOR Final Report
John O. Reller, Jr., Carr B. Neel, and Louis C. Haughney Jul. 1976 245 p refs Sponsored in part by ESA
(NASA-TM-X-73150; A-6668) Avail: NTIS HC A11/MF A01 CSCL 22B

A joint NASA/ESA endeavor was established to conduct an extensive spacelab simulation using the NASA CV-990 airborne laboratory. The scientific payload was selected to perform studies in upper atmospheric physics and infrared astronomy with principal investigators from France, the Netherlands, England, and several groups from the United States. Two experiment operators from Europe and two from the U.S. were selected to live aboard the aircraft along with a mission manager for a six-day period and operate the experiments in behalf of the principal scientists. This appendix discusses the experiment operators and their relationship to the joint mission under the following general headings: selection criteria, training programs, and performance. Author

N77-14178# Acurex Corp., Mountain View, Calif. Aerotherm Div.
PASSIVE NOSETIP TECHNOLOGY (PANT) PROGRAM. VOLUME 17: COMPUTER USER'S MANUAL: EROSION SHAPE (EROS) COMPUTER CODE Interim Report, Apr. 1974 - Mar. 1975
D. Rafinejad and C. Derbidge Dec. 1974 197 p refs
(Contract F04701-74-C-0069)
(AD-A026613; AEROTHERM-UM-74-57-Vol-17; SAMSO-TR-74-86-Vol-17) Avail: NTIS HC A09/MF A01 CSCL 16/3

A computer program is developed to numerically model the in-depth transient response and shape history of an ablating nosetip subjected to a reentry environment. The generality of the input also allows the user to conveniently analyze the boundary layer, shape change and in-depth response of many materials in a variety of test facilities. The computer code is capable of handling nosetips of shell or plug geometries. The boundary layer and heat transfer distribution are modeled for a variety of environments including hydrometer erosion. GRA

N77-14179# Acurex Corp., Mountain View, Calif. Aerotherm Div.
PASSIVE NOSETIP TECHNOLOGY (PANT) PROGRAM. VOLUME 18: NOSETIP ANALYSES USING THE EROS COMPUTER CODE Interim Report, Apr. 1974 - Mar. 1975
G. J. Neuner, M. R. Wool, and R. A. Berry Jun. 1975 90 p refs
(Contract F04701-74-C-0069)
(AD-A026614; AEROTHERM-74-100-Vol-18; SAMSO-TR-86-Vol-18) Avail: NTIS HC A05/MF A01 CSCL 16/3

The results of nosetip response calculations using the newly-developed, EROsion Shape (EROS) computer code are documented. The code enables the evaluation of nosetip coupled erosion and ablation and shape change for arbitrary materials including fine weave carbon/carbon, polycrystalline graphite, and reinforced phenolics. Transient heat conduction is also treated through an innovative explicit differencing scheme. Calculations are presented for wind tunnel test environments, ICBM clear air flight conditions, and Terrier-Recruit sounding rocket flight conditions. In the analysis matrix, modeling techniques are varied to identify response sensitivity to modeling uncertainties. The primary conclusions are that: Transition altitude and overall recession of ICBM nosetips in clear air are critically sensitive to material roughness characteristics. Hydrometeor impacts cause significant nosetip erosion mass loss and increased surface thermochemical mass loss. GRA

N77-14180# Acurex Corp., Mountain View, Calif. Aerotherm Div.
PASSIVE NOSETIP TECHNOLOGY (PANT) PROGRAM. VOLUME 19: HYDROMETEOR/SHOCK LAYER INTERACTION STUDY Interim Report, Dec. 1974 - Jun. 1975
W. E. Nicolet, M. R. Wool, B Laub, and N. A. Jaffe Aug. 1975 81 p refs
(Contract F04701-71-C-0027)
(AD-A026615; AEROTHERM-75-163-Vol-19; SAMSO-TR-74-86-Vol-19) Avail: NTIS HC A05/MF A01 CSCL 16/3

Hypersonic vehicles during reentry may experience extensive damage due to encounters with condensed phase H2O (hydrometeors) in the form of either ice particles or liquid droplets. These encounters, which can lead to augmented heating rates and mechanical erosion, must traverse the shocked gas enveloping the reentry vehicle prior to impacting the surface. The shock layer can, depending on flight conditions, vehicle configuration, and particle size, have a marked influence on the hydrometeors traversing the region between the shock wave and the body surface. Hence, an understanding of hydrometeor/shock layer interaction is required in order to predict impact conditions from specified vehicle configuration and free stream conditions. This report documents the results of an investigation directed at surveying a portion of the phenomenology associated with the interaction between water droplets and strong shock waves. GRA

N77-14181# Acurex Corp., Mountain View, Calif. Aerotherm Div.
PASSIVE NOSETIP TECHNOLOGY (PANT) PROGRAM. VOLUME 20: INVESTIGATION OF FLOW PHENOMENA OVER REENTRY VEHICLE NOSETIPS Interim Report, Dec. 1974 - Jun. 1975
M. J. Abbett, A. D. Anderson, L. Cooper, T. J. Dahm, and J. Kelly Aug. 1975 125 p refs
(Contract F04701-71-C-0027)
(AD-A026617; AEROTHERM-75-164-Vol-20; SAMSO-TR-74-86-Vol-20) Avail: NTIS HC A06/MF A01 CSCL 16/3

The third phase of the PANT program was directed toward better characterizing the dependence of irregular shape development on the aerothermal environment and identifying needed improvements in analytical modeling to better predict nosetip shape response in flight environments. Specific areas which were addressed included coupled ablation/erosion effects, inviscid and boundary layer flow effects, nosetip transition on advanced, 'smooth' materials, and irregular shape regime onset. This report documents the results of efforts on the inviscid flow, 'smooth' wall nosetip transition, and turbulent boundary layer heat transfer tasks. GRA

N77-14182# Acurex Corp., Mountain View, Calif. Aerotherm Div.
PASSIVE NOSETIP TECHNOLOGY (PANT) PROGRAM. VOLUME 22: COUPLED EROSION/ABLATION OF REENTRY MATERIALS Interim Report, Dec. 1974 - Jun. 1975
C. J. Wolf, C. T. Nardo, and T. J. Dahm Jul. 1975 89 p refs
(Contract F04701-71-C-0027)
(AD-A026619; AEROTHERM-75-160-Vol-22; SAMSO-TR-74-86-Vol-22) Avail: NTIS HC A05/MF A01 CSCL 16/3

A study of coupled erosion/ablation effects in flight and ballistic range environments is conducted with the objectives of identifying and quantifying the sources, magnitudes and consequences of uncertainties associated with the data and phenomenology on which shape change calculations are based. The interactions of the phenomena of temperature dependent single impact mass loss and erosion induced augmented heating as key elements within the morphology of coupled effects are investigated. A test plan consisting of complementary single impact and ballistic range experiments is presented in which the material samples, the impacting particle, the impact velocity and the thermal state of the material are closely matched. GRA

N77-14106*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FACILITIES AND EXPERIMENT RESULTS OF THE NASA SOUNDING ROCKET PROGRAM
R. S. Snyder *In* ESA Mater. Sci. in Space Sep. 1976 p 341-349 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14122# Centre National d'Etudes Spatiales, Paris (France).
ROCKETS AND BALLOONS. THE FRENCH PROGRAMME
G. Weill *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 17-22 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14123# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE GERMAN SCIENTIFIC BALLOON AND SOUNDING-ROCKET PROGRAMME
D. Joneleit *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 23-30 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14124# Swedish Space Corp., Stockholm.
THE SWEDISH SOUNDING-ROCKET PROGRAMME 1976-1980
P. Zetterquist *In* ESA European Programmes on Sounding-Rocket and Balloon Res. (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01 in the Auroral Zone 1976 p 35-48

N77-14125# Appleton Lab., Slough (England).
THE FUTURE BRITISH SOUNDING ROCKET PROGRAMME IN THE AURORAL ZONE
J. T. Delury *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 49-52 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14143# European Space Research and Technology Center, Noordwijk (Netherlands).
SITUATION REPORT ON GEOS
K. Knott *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 315-322 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14144# European Space Research and Technology Center, Noordwijk (Netherlands).

DEVELOPMENT REPORT ON THE ISEE MISSION
A. C. Durney *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 323-333 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14147# Liege Univ. (Belgium).
THE E1 EXPERIMENT ABOARD S 22 PAYLOAD: CAPABILITIES OF THE PROTOTYPE MODEL
J. Jamar, J. P. Macau, R. Duysinx, M. Henrist, and A. Monfils *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 343-349 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14155# British Aircraft Corp. (Operating) Ltd., Bristol (England).
RECENT ADDITIONS TO THE SKYLARK FAMILY OF SOUNDING ROCKETS
D. J. Brown *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 439-453 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14156# British Aircraft Corp. (Operating) Ltd., Bristol (England).
FREE SPACE MOTION OF THE SKYLARK 12 SOUNDING ROCKET
W. Johnson *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 455-472 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14157# Bristol Aerospace, Ltd., Winnipeg (Manitoba).
NIKE-BLACK BRANT 5C AND XM-75 TWO QUALIFIED SOUNDING ROCKETS FOR THE USER WITH VERY HEAVY PAYLOADS OR VERY LIGHT PAYLOADS
J. R. Bevis *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 473-483 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14158# Bristol Aerojet, Ltd., Banwell (England).
PETREL 3 AND SKUA 4: EARTH RESOURCES SURVEY ROCKETS
S. J. Pooley *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 485-495 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14159# Swedish Space Corp., Solna.
DEVELOPMENT OF THE S19 GUIDANCE SYSTEM FOR THE REDUCTION OF SOUNDING ROCKET DISPERSION
L. Anderson and J. Andersson (Saab-Scania, Linkoeping, Swed.) *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 497-511 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14160# Societe d'Applications Generales d'Electricite et de Mecanique, Paris (France).
INERTIAL UNITS FOR ATTITUDE CONTROL OF PROBE ROCKETS
M. G. Monier *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 513-524 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14161# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
DEVELOPMENT TRENDS IN PAYLOAD CONTROL SYSTEMS
John J. Turner *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 529-540 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14162# Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejon de Ardoz (Spain).
FLAMENCO SOUNDING ROCKET
J. Simon, A. Mateo, and M. Vazquez *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 541-549 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N77-14183*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPACE SHUTTLE ORBITER TRIMMED CENTER-OF-GRAVITY EXTENSION STUDY: VOLUME 2: EFFECTS OF CONFIGURATION MODIFICATIONS ON THE AERODYNAMIC CHARACTERISTICS OF THE 140 A/B ORBITER AT TRANSONIC SPEEDS
W. Pelham Phillips Sep. 1976 277 p refs
(NASA-TM-X-72661-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 22B

Tests were conducted in the LaRC 8-foot transonic pressure tunnel to determine effects of fuselage nose and wing fillet modifications on the transonic aerodynamic characteristics of a space shuttle orbiter configuration. In addition to reshaping the baseline wing planform fillet, small canards were added to the configuration. The modifications considered were of interest in extending the forward center-of-gravity boundary for the configuration. Author

N77-14184*# TRW Defense and Space Systems Group, Redondo Beach Calif.
PHASE B: FINAL DEFINITION AND PRELIMINARY DESIGN STUDY FOR THE INITIAL ATMOSPHERIC CLOUD PHYSICS LABORATORY (ACPL): A SPACELAB MISSION PAYLOAD. FINAL REVIEW (DR-MA-03)
O. W. Clausen 7 Dec. 1976 371 p
(Contract NAS8-31844)
(NASA-CR-150136) Avail: NTIS HC A16/MF A01 CSCL 22C

Systems design for an initial atmospheric cloud physics laboratory to study microphysical processes in zero gravity is presented. Included are descriptions of the fluid, thermal, mechanical, control and data, and electrical distribution interfaces with Spacelab. Schedule and cost analysis are discussed. Author

N77-14185*# National Aeronautics and Space Administration, Washington, D.C.
SPACELAB USERS GUIDE: A SHORT INTRODUCTION TO SPACELAB AND ITS USE
Nov. 1976 24 p
(NASA-TM-X-74312; ESA-SP-1001) Avail: NTIS HC A02/MF A01 CSCL 22A

Spacelab is an orbital facility that provides a pressurized, 'shirt-sleeve' laboratory (the module) and an unpressurized platform (the pallet), together with certain standard services. It is a reusable system, which is transported to and from orbit in the cargo bay of the space shuttle orbiter and remains there throughout the flight. Spacelab extends the shuttle capability, and the Orbiter/Spacelab combination can be regarded as a short-stay space station which can remain in orbit for up to 30 days (the nominal mission duration is 7 days). In orbit, the experiments carried by Spacelab are operated by a team of up to four payload specialists who normally work in the laboratory, but spend their off-duty time in the orbiter cabin. The purpose of Spacelab is to provide a ready access to space for a broad spectrum of experimenters in many fields and from many nations. Low-cost techniques are envisaged for experiment development, integration and operation. The aim of this document is to provide a brief summary of Spacelab design characteristics and its use potential for

experimenters wishing to take advantage of the unique opportunities offered for space experimentation. Author

N77-14186*# Transemantics, Inc., Washington, D.C.
WHAT IS THE SPACE TRANSPORTATION SYSTEM, SPACESHUTTLE, LEGALLY?
A. Bueckling Washington NASA Dec. 1976 9 p refs Transl. into ENGLISH of Z. fuer Luft- und Weltraum-Rechts (West Ger.), v. 24, no. 3, Sep. 1975 p 183-188
(Contract NASw-2792)
(NASA-TT-F-17506) Avail: NTIS HC A02/MF A01 CSCL 22A

The definition of a space shuttle craft is discussed as a space object as opposed to an aircraft. It concludes that the take-off configuration of the space shuttle is a space object, and that all fuel tanks, boosters, etc. attached to the shuttle craft remain space objects until they fall back to earth's surface, and that the shuttle craft (also called the space orbiter) preserves its property as a space object after starting back from orbit to earth, and does so until its landing. Author

N77-14187# Defense Systems Management School, Fort Belvoir, Va.
MANAGEMENT OF DOD SPACE PAYLOAD INTEGRATION IN THE SPACE SHUTTLE ERA
Henry W. Steinkamp, Jr. May 1976 62 p refs
(AD-A026384; DSMS-PMC-76-1) Avail: NTIS HC A04/MF A01 CSCL 05/1

This report reviews the current management of DOD launch vehicle/spacecraft integration and then shows how the characteristics of the space shuttle will require changes to this baseline. The study has been based on a review of NASA and DOD literature, interviews with knowledgeable USAF officials and the author's experience in expendable launch vehicle planning and in Shuttle payload integration development. The results of the investigation provided supporting rationale for establishing a centralized DOD payload/space shuttle integration management structure. An important question was whether centralized management would motivate more economical utilization of the shuttle. In comparison to management decentralized to satellite System Program Offices of Industrial Fund Techniques, it was concluded that centralization would be more effective and efficient. Author (GRA)

N77-14067# European Space Agency, Paris (France).
SHUTTLE AND SPACELAB CAPABILITIES
D. J. Shapland *In its* Mater. Sci. in Space Sep. 1976 p 3-18 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14072# European Space Agency, Paris (France).
ESA SPACELAB PAYLOAD PLANNING
J. Collet *In its* Mater. Sci. in Space Sep. 1976 p 57-61 (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14077# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
ACCOMMODATION OF EUROPEAN MATERIAL-SCIENCE EXPERIMENTS ON SPACELAB
P. Zimmermann *In* ESA Mater. Sci. in Space Sep. 1976 p 115-127 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N77-14188*# National Aeronautics and Space Administration, Washington, D.C.
A HISTORY OF THE DEEP SPACE NETWORK
William R. Corliss Nov. 1976 237 p refs
(Contract NASw-2728)
(NASA-CR-151915) Avail: NTIS HC A11/MF A01 CSCL 14B

The Deep Space Network (DSN) has been managed and operated by the Jet Propulsion Laboratory (JPL) under NASA contract ever since NASA was formed in late 1958. The Tracking and data acquisition tasks of the DSN are markedly different from those of the other NASA network, STDN. STDN, which is an amalgamation of the satellite tracking network (STADAN) and the Manned Space Flight Network (MSFN), is primarily concerned with supporting manned and unmanned earth satellites. In contrast, the DSN deals with spacecraft that are thousands to hundreds of millions of miles away. The radio signals from these distant craft are many orders of magnitude weaker than those from nearby satellites. Distance also makes precise radio location more difficult; and accurate trajectory data are vital to deep space navigation in the vicinities of the other planets of the solar system. In addition to tracking spacecraft and acquiring data from them, the DSN is required to transmit many thousands of commands to control the sophisticated planetary probes and interplanetary monitoring stations. To meet these demanding requirements, the DSN has been compelled to be in the forefront of technology. Author

N77-14189# Sandia Labs., Albuquerque, N.Mex. Telemetry Development Div.
PERFORMANCE CHARACTERISTICS OF TELEMETRY TRANSMISSION SYSTEMS
Harold O. Jeske 1976 16 p refs Presented at 22d Intern. Instrumentation of the Instrument Soc. of Am., San Diego, Calif., 25 May 1976 Sponsored by ERDA
(SAND-76-5304; Conf-760513-6) Avail: NTIS HC A02/MF A01

The design of telemetry transmission systems encompasses many considerations. It is basically a communications system designed for a specific purpose. In all communications systems the signal-to-noise ratio on the system output is of prime concern which is determined, to some degree, by all components in the system. The salient characteristics of telemetry ground station components are discussed including the use of polarization diversity to greatly enhance the probability of reliable data transmission. A simplified presentation of the characteristics of FM signals and the performance of FM system components under ideal and adverse conditions is also presented. ERA

N77-14190# Sandia Labs., Albuquerque, N.Mex. Telemetry Development Div.
INTRODUCTION TO TELEMETRY DATA SYSTEMS
Charles S. Johnson 1976 22 p refs Presented at 22d Intern. Instrumentation of the Instrument Soc. of Am., San Diego, Calif., 25 May 1976 Sponsored by ERDA
(SAND-76-5196; Conf-760513-7) Avail: NTIS HC A02/MF A01

Telemetry systems are designed to carry electrical signals from remotely located transducers and to reproduce the signals for analysis. Telemetry configurations fall under two broad categories: frequency division multiplex systems and time division multiplex systems. A basic introduction into these categories of telemetry systems is given. Author

N77-14191# Army Electronics Command, Fort Monmouth, N.J.
IONOSPHERIC AND PLASMASPHERIC EFFECTS IN SATELLITE NAVIGATION SYSTEMS
Haim Soicher 1976 15 p refs
(AD-A026157) Avail: NTIS HC A02/MF A01 CSCL 17/7

A space-based radio navigation system could provide military and civilian users with precise three-dimensional position and velocity data. The navigation signals would contain data such as satellite identity, real-time ephemerides information, system time, and other needed information. To determine his position and velocity, the user will cross-correlate the coded time signal received from the satellite with the same coded time signal generated in his receiver. The phase difference, or equivalently

the time displacement, between the phase at the user's receiver and the incoming phase, determines the range to the satellite. Simultaneous measurement of such relative phases from four different satellites will permit the user to determine his range and his clock bias with respect to the satellite's position and clock, respectively. GRA

N77-14192# Naval Ship Research and Development Center, Bethesda, Md. Dept. of Central Instrumentation.
PORTABLE TEST UNIT (PTU)
Barry L. Zimmerman Jun. 1976 40 p
(AD-A026845; CID-76-1) Avail: NTIS HC A03/MF A01 CSCL 17/7

A Portable Test Unit was developed and built to control and monitor operation of instrumentation packages used to obtain motion data from navigational buoys. Features of the Portable Test Unit, and operational and alignment procedures are described. The Portable Test Unit (PTU) is part of the instrumentation developed by the David W. Taylor Naval Ship Research and Development Center (DTNSRDC) for the U.S. Coast Guard, Office of Research and Development. The Coast Guard (USCG) is evaluating new plastic buoy designs to improve reliability and reduce costs of maintaining vital navigational aids. The PTU is a small, lightweight package which can communicate with a buoy package through either the radio telemetry link or a direct wire connection. The PTU can command the buoy package to turn on and off, and to send calibration (cal) and data signals. It can receive and demodulate buoy package telemetry signals to display real time data. The PTU also contains several general purpose test instruments. The PTU greatly simplifies the diagnosis and repair of malfunctions in buoy packages. It assures successful buoy deployments by making it possible to check the buoy packages for proper operation before leaving the deployment site. The PTU can act as a control station to obtain motion data from a single buoy deployed away from the main control station site. GRA

N77-14050*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TERMINOLOGY OF RANGING MEASUREMENTS AND DSS CALIBRATIONS
T. Komarek and T. Otoshi *In its* The Deep Space Network 15 Dec. 1976 p 35-40 ref (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N77-14052*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN IMPROVED UPPER BOUND ON THE BLOCK CODING ERROR EXPONENT FOR BINARY INPUT DISCRETE MEMORYLESS CHANNELS
R. J. McEliece and J. K. Omura (Calif. Univ., Los Angeles) *In its* The Deep Space Network 15 Dec. 1976 p 45-48 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N77-14058*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM PERFORMANCE WITH CONVOLUTIONALLY CODED DATA USING OPERATIONAL MAXIMUM-LIKELIHOOD CONVOLUTIONAL DECODERS
B. Benjauthrit, B. Mulhall, B. D. Madsen, and M. E. Alberda *In its* The Deep Space Network 15 Dec. 1976 p 81-101 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N77-14061*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIFFERENTIAL RANGE VALIDATION: A NEW TECHNIQUE FOR NEAR-REAL-TIME VALIDATION OF MULTISTATION RANGING SYSTEM DATA
A. L. Berman *In its* The Deep Space Network 15 Dec. 1976 p 114-120 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N77-14063*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSS RANGE DELAY CALIBRATIONS: CURRENT PERFORMANCE LEVEL
G. L. Spradlin *In its* The Deep Space Network 15 Dec. 1976 p 138-152 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N77-14163# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
A LOOK AT THE FUTURE REQUIREMENTS FOR TELEMETRY DATA TRANSMISSION IN SOUNDING ROCKET AND BALLOON PROJECTS
G. Mayer and G. E. Todd *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 551-556 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-14193*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR CELL ARRAY DESIGN HANDBOOK, VOLUME 1
H. S. Rauschenbach Oct. 1976 496 p refs Prepared by TRW Defense and Space Systems Group, Redondo Beach, Calif. 2 Vol.
(Contracts NAS7-100; JPL-953913)
(NASA-CR-149364; JPL-SP-43-38-Vol-1) Avail: NTIS HC A21/MF A01 CSCL 22B

Twelve chapters discuss the following: historical developments, the environment and its effects, solar cells, solar cell filters and covers, solar cell and other electrical interconnections, blocking and shunt diodes, substrates and deployment mechanisms, material properties, design synthesis and optimization, design analysis, procurement, production and cost aspects, evaluation and test, orbital performance, and illustrative design examples. A comprehensive index permits rapid locating of desired topics. The handbook consists of two volumes: Volume 1 is of an expository nature while Volume 2 contains detailed design data in an appendix-like fashion. Volume 2 includes solar cell performance data, applicable unit conversion factors and physical constants, and mechanical, electrical, thermal optical, magnetic, and outgassing material properties. Extensive references are provided. Author

N77-14194*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR CELL ARRAY DESIGN HANDBOOK, VOLUME 2
Oct. 1976 251 p refs 2 Vol.
(Contract NAS7-100)
(NASA-CR-149365; JPL-SP-43-38-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 22B

For abstract, see N77-14193.

N77-14195# Air Force Weapons Lab., Kirtland AFB, N.Mex.
THE EFFECT OF INTENSE NUCLEAR RADIATION DAMAGE ON THE MECHANICAL PROPERTIES OF REENTRY VEHICLE-LIKE MATERIALS Final Report
charles Stein May 1976 46 p refs
(AF Proj. 8809)
(AD-A026554; AFWL-TR-76-70) Avail: NTIS HC A03/MF A01 CSCL 18/8

The ability of a reentry vehicle to sustain the radiation effects of a near nuclear burst and to successfully complete its mission depends to a large measure on the resulting damage to the loadbearing structural shell. To determine what changes in mechanical properties resulted from the exposure of copper-aluminum alloys to the intense radiation of a nuclear device, the yield strength dislocation densities, changes in strain-rate, Young's Modulus, strain-rate sensitivity factor, Cottrell-Stokes ratio, and work hardening mechanisms were studied as a function of radiation damage in single crystals of these alloys, which were tensile tested after nuclear exposure. The results of this program could influence input information used in our future prediction capabilities of fratricide against our own vehicles and in suggesting new hardening concepts which can increase the survivability of our future reentry vehicles. Author (GRA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-14196*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
INERT GAS THRUSTERS Annual Report
Harold R. Kaufman Jul. 1976 97 p refs
(Grant NsG-3011)
(NASA-CR-135100) Avail: NTIS HC A05/MF A01 CSCL 21C

Inert gases are of interest as possible alternatives to the usual electric thruster propellants of mercury and cesium. The multipole discharge chamber investigated was shown capable of low discharge chamber losses and flat ion beam profiles with a minimum of optimization. Minimum discharge losses were 200 to 250 eV/ion for xenon and 300 to 350 eV/ion for argon, while flatness parameters in the plane of the accelerator grid were 0.85 to 0.95. The design used employs low magnetic field strengths, which permits the use of sheet-metal parts. The corner problem of the discharge chamber was resolved with recessed corner anodes, which approximately equalized both the magnetic field above the anodes and the electron currents to these anodes. Argon hollow cathodes were investigated at currents up to about 5 amperes using internal thermionic emitters. Cathode chamber diameter optimized in the 1.0 to 2.5 cm range, while orifices diameter optimized in the 0.5 to 5 mm range. The use of a bias voltage for the internal emitter extended the operating range and facilitated starting. The masses of 15 and 30 cm flight type thrusters were estimated at about 4.2 and 10.8 kg. Author

N77-14197*# Physical Sciences, Inc., Woburn, Mass.
LASER-HEATED ROCKET STUDIES Final Report, 28 Apr. 1975 - 28 Apr. 1976
N. H. Kemp, R. G. Root, P. K. S. Wu., G. E. Caledonia, and A. N. Pirri May 1976 127 p refs
(Contract NAS3-19695)
(NASA-CR-135127; PSI-TR-53) Avail: NTIS HC A07/MF A01 CSCL 21C

CW laser heated rocket propulsion was investigated in both the flowing core and stationary core configurations. The laser radiation considered was 10.6 micrometers, and the working gas was unseeded hydrogen. The areas investigated included initiation of a hydrogen plasma capable of absorbing laser radiation, the radiation emission properties of hot, ionized hydrogen, the flow of hot hydrogen while absorbing and radiating, the heat losses from the gas and the rocket performance. The stationary core configuration was investigated qualitatively and semi-quantitatively. It was found that the flowing core rockets can have specific impulses between 1,500 and 3,300 sec. They are small devices, whose heating zone is only a millimeter to a few centimeters long, and millimeters to centimeters in radius, for laser power levels varying from 10 to 5,000 kW, and pressure levels of 3 to 10 atm. Heat protection of the walls is a vital necessity, though the fraction of laser power lost to the walls can be as low as 10% for larger powers, making the rockets thermally efficient. Author

N77-14198*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NONLINEAR BEHAVIOR OF ACOUSTIC WAVES IN COMBUSTION CHAMBERS
F. E. C. Culick Apr. 1975 129 p refs
(Contract NAS7-100)
(NASA-CR-149367) Avail: NTIS HC A07/MF A01 CSCL 21H

The nonlinear growth and limiting amplitude of acoustic waves in a combustion chamber are considered. A formal framework is provided within which practical problems can be treated with a minimum of effort and expense. The general conservation equations were expanded in two small parameters, one characterizing the mean flow field and one measuring the amplitude of oscillations, and then combined to yield a nonlinear inhomogeneous wave equation. The unsteady pressure and velocity fields were expressed as syntheses of the normal modes of the chamber, but with unknown time-varying amplitudes. This procedure yielded a representation of a general unsteady field as a system of coupled nonlinear oscillators. The system of nonlinear equations was treated by the method of averaging to produce a set of coupled nonlinear first order differential equations for the amplitudes and phases of the modes. The analysis is applicable to any combustion chamber. The most interesting applications are probably to solid rockets, liquid rockets, or thrust augmentors on jet engines. Author

N77-14199# Texas Instruments, Inc., Dallas. Semiconductor Group.
DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER, VOLUME 2 Final Report, Jun. 1974 - Jun. 1975
W. W. Lloyd, Richard Yeakley, Clyde Fuller, and Farris Malone Wright-Patterson AFB., Ohio AFAPL Nov. 1975 52 p refs
(Contract F33615-73-C-2019; AF Proj. 3145)
(AD-A025719; TI-03-75-41; AFAPL-TR-74-45-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 10/2

Based on the types of vertical multijunction cells developed in the first half of this contract (Report No. AFAPL-TR-74-45), the open-groove type configuration was selected since early characterization results showed the predicted improvements in long-wave response and tolerance to electron bombardment. In addition, a process was developed that converts the surface of this cell into an effective black body, which also has the potential of reducing the area of the collecting junction. Cells made using the black-surface, open-groove structure have demonstrated that the short circuit current has dropped only 13% after exposure to 10 to the 16th power, MeV electrons; the blue response is not limited by the deep grooves; the long-wave response can be 30% higher than for a conventional cell; actual efficiencies of 9% have been obtained, with a clear potential of reaching 14%. Together with the significantly simplified processes developed for the fabrication of the cells, these results show that the Vertical Multijunction cell is a viable device for spacecraft power. Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N77-14200 British Library Lending Div., Boston Spa (England).
SOLUBILITY OF DYES IN ORGANIC SOLVENTS
Gunther Reidel Sep. 1976 21 p refs Transl. into ENGLISH from Farbe und Lack, West Germany, v. 4, no. 82, 1976 p 281-289
(BLL-RTS-10354) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas or 30 UK BLL photocopy coupons

The solubility characteristics of cation or basic dyes, metal complex dyes and so-called non-ionogenous dyes are examined on typical representative samples and described and interpreted with the aid of a solubility parameter. Author

24 COMPOSITE MATERIALS

Includes laminates.

N77-14201 Washington Univ., Seattle.
DYNAMIC TORSIONAL RESPONSE OF INDIVIDUAL CARBON FIBERS Ph.D. Thesis
Roy Eldon Hendrichsen 1976 515 p
Avail: Univ. Microfilms Order No. 76-25416

The dynamic torsional characteristics of carbon and graphite fibers were investigated to give new insights into the structure-property relationships and to provide useful engineering data. The characteristics were measured at room temperature with a low frequency vacuum split torsion pendulum apparatus. Commercial fibers produced from either a rayon, polyacrylonitrile (PAN), or isotropic pitch precursor were tested in the as-received condition. Silica fibers were also measured for comparison.
Dissert. Abstr.

DATA SUMMARY: Data Summary not prepared due to nonavailability of complete document for processing.

N77-14202*# Scientific Translation Service, Santa Barbara, Calif.
ELECTRICAL RESISTIVITY OF CARBON BLACK KAOLIN SINTERED MATERIALS, 2
Etsuro Kato Washington NASA Dec. 1976 36 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 68, no 3, 1965 p 442-449
(Contract NASw-2791)
(NASA-TT-F-17340) Avail: NTIS HC A03/MF A01 CSCL 11D

C solid resistors containing furnace black less than 15% in kaolin were made and fired at 800-1,400 C for 1 hr. The vol. contraction of the resistor occurs at 500 C (due to dehydration), 1,000 C (destruction of metakaolin structure), and 1,100 C (pptn. of mullite and vitrefication). The elec. resistivity changes with the firing temp., corresponding to the vol. changes. When fired at less than 1,300 C, the log of the sp. resistance, p, is linear with the reciprocal of the bulk C d., C, in the region of low p.
Author

DATA SUMMARY: Calcination temperature and carbon bulk density effects; variables include sintering temperature, contraction rate, density, specific resistance, admixture rate, and compression; 13 figures and 3 tables are included.

N77-14203*# Scientific Translation Service, Santa Barbara, Calif.
SOME PROPERTIES OF GLASSY CARBON
S. Yamada and H. Sato Washington NASA Dec. 1976 6 p ref Transl. into ENGLISH from Kogyo Kaguka Zasshi (Tokyo), v. 65, 1962 p 1139-1140
(Contract NASw-2791)
(NASA-TT-F-17341) Avail: NTIS HC A02/MF A01 CSCL 11D

Glassy carbon was produced. Its characteristics are: when the temperature of treatment is 1,300 or 3,000 deg, the apparent d. is, resp., 1.46-1.50 or 1.43-1.48 g/ml, porosity is 0.2-0.4 or 0.5-1.0%, max. pore diam. 1,000 A., flexural strength 500-1,000 kg/sq cm, elec. resistivity 35-50 x 0.0001 or 30-5 x 0.0001 ohm-cm, gas permeability 0.00000000001-0.000000000001 or 0.000000001 sq cm/sec, thermal cond. 3-4 or 13-15 kcal/m hr C, and thermal expansion coeff. 1.8-2.0 x 0.000001 C. From these characteristics, its appearance, and rupture face, it closely resembles glass.
Author

DATA SUMMARY: Carbonization and permeation methods to obtain impermeable carbon; the variables include heat treatment, carbonization, secondary permeation, porosity, and weight loss; 1 figure and 3 tables are included.

N77-14204*# Scientific Translation Service, Santa Barbara, Calif.
ELECTRICAL RESISTIVITY OF CARBON BLACK KAOLIN COMPOSITE SINTERED MATERIALS
E. Kato Washington NASA Dec. 1976 33 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 67, no. 12, 1964 p 2026-2032
(Contract NASw-2791)
(NASA-TT-F-17342) Avail: NTIS HC A03/MF A01 CSCL 11D

Mixtures of kaolin and 0 to 15 wt.% carbon black were molded by extrusion and fired in carbon black powder. The electrical resistance of the product was measured. When the C content was < 2 to 3%, the electrical resistance of the product was independent of the C content, and determined by the firing temperature, being equal to that of kaolin itself fired in air. When the C content was > 3%, the resistance decreased rapidly with the increase of C content. For a product of low resistance, the equation p = Ae sup k/C holds, in which p is the resistivity of the samples fired at the same temperature, C is the carbon content by volume of the fired product calculated, and K and A are constants. At C > 0.09 g/ml, log was proportional to 1/c. In this range, the C particles were connected with each other. At 11 < 1/C < 20, the isolation of particles started, resulting in a rapid increase in the resistance. At a critical concentration of 1/C = 20, all of the C particles were isolated from each other, and the resistance became that of an insulator.
Author

DATA SUMMARY: Relation between firing time and carbon content; variables are sintering, temperature effects, density (mass/volume), chemical composition; contraction; 10 figures include numerical data.

N77-14205*# Lockheed-California Co., Burbank.
DEVELOPMENT OF FIRE RESISTANT, NONTOXIC AIRCRAFT INTERIOR MATERIALS Technical Report, 21 Jun. 1975 - 30 Sep. 1976
G. Haley, B. Silverman, and Y. Tajima Sep. 1976 91 p refs
(Contract NAS2-8835)
(NASA-CR-137920) Avail: NTIS HC A05/MF A01 CSCL 11D

All available newly developed nonmetallic polymers were examined for possible usage in developing fire resistant, nontoxic nonmetallic parts or assemblies for aircraft interiors. Specifically, feasibility for the development of clear films for new decorative laminates, compression moldings, injection molded parts, thermoformed plastic parts, and flexible foams were given primary considerations. Preliminary data on the flame resistant characteristics of the materials were obtained. Preliminary toxicity data were generated from samples of materials submitted from the contractor.
Author

DATA SUMMARY: Comparison of polymeric materials; variables are smoke, flammability, compressibility, modulus of elasticity, tensile strength, thermal resistance, toxicity, adhesive bonding; 20 figures and 9 tables include numerical data.

N77-14206*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THERMOPLASTIC POLYMERS FOR IMPROVED FIRE SAFETY
Demetrius A. Kourtides, John A. Parker, and C. J. Hilado Nov. 1976 56 p refs
(NASA-TM-X-73185; A-6832) Avail: NTIS HC A04/MF A01 CSCL 11D

The thermochemical and flammability characteristics of some typical thermoplastic materials currently in use and others being considered for use in aircraft interiors are described. The properties studied included (1) thermomechanical properties such as glass transition and melt temperature, (2) changes in polymer enthalpy by differential scanning calorimetry, (3) thermogravimetric analysis in anaerobic and oxidative environments, (4) oxygen index, (5) smoke evolution, (6) relative toxicity of the volatile products of pyrolysis, and (7) selected physical properties.
Author

DATA SUMMARY: Thermochemical analyses of 12 thermoplastic materials; variables include glass transition temperature, melting temperature, smoke evolution, char yield, toxicity, time

to death, oxygen index; 15 figures and 16 tables include numeric data.

N77-14207*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DIFFUSION ANALYSIS FOR TWO-PHASE METAL-MATRIX COMPOSITE
Darrel R. Tenney Washington Dec. 1976 34 p refs
(NASA-TN-D-8299; L-10682) Avail: NTIS HC A03/MF A01 CSCL 11D

Diffusion controlled filament matrix interaction in a metal matrix composite, where the filaments and matrix comprise a two phase binary alloy system, was mathematically modeled. The problem of a diffusion controlled, two phase moving interface by means of a one dimensional, variable grid, finite difference technique was analyzed. Concentration dependent diffusion coefficients and equilibrium solubility limits were used, and the change in filament diameter and compositional changes in the matrix were calculated as a function of exposure time at elevated temperatures. With the tungsten nickel (W-Ni) system as a model composite system, unidirectional composites containing from 0.06 to 0.44 initial filament volume fraction were modeled. Compositional changes in the matrix were calculated by superposition of the contributions from neighboring filaments. Author

DATA SUMMARY: Mathematical modeling of moving interface in tungsten-nickel filament system; the variables include time, temperature, composition variation, solibility, atomic fraction, and volume; 15 figures and 1 table are included.

N77-14208*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN IMPROVED AUTOMOTIVE BRAKE LINING USING FIBROUS POTASSIUM TITANATE
Joseph A. Mansfield, Marcel L. Halberstadt (Bendix Res. Lab, Southfield, Mich.), Salvatore R. Riccitiello, and Seong K. Rhee (Bendix Res. Lab, Southfield, Mich.) Washington Dec. 1976 15 p refs
(NASA-TN-D-8363; A-6733) Avail: NTIS HC A02/MF A01 CSCL 11D

Simultaneous fade reduction and wear improvement of a commercial automotive brake lining were achieved by adding fibrous potassium titanate. The dependence of friction and wear characteristics on quantitative variations in potassium titanate, asbestos, phenolic binder, and organic and inorganic modifiers was evaluated. Author

DATA SUMMARY: Friction and wear measurements of fibrous potassium titanate composites of 18- 21- 24% binder volume; variables are friction coefficient, wear, low temperature, high temperature, potassium titanate to asbestos ratio; 12 figures and 4 tables include numeric data.

N77-14209*# Kanner (Leo) Associates, Redwood City, Calif.
NEW MOLYBDENUM SULFIDE, Mo3S4: PREPARATION, PROPERTIES, AND CRYSTAL STRUCTURE
R. Chevrel, M. Sergent, and J. Prigent Dec. 1976 16 p refs Transl. into ENGLISH from Mater. Res. Bull. (US), vol. 9, no. 11, 1974 p 1487-1498
(Contract NASw-2790)
(NASA-TT-F-17330) Avail: NTIS HC A02/MF A01 CSCL 11D

A sulfide of Mo, Mo3S4, isostructural with Mo3Se4, was prepared. Its crystallographic cell is rhombohedral. Its structure is characterized by a Mo6S8 unit formed by a Mo6 octahedral cluster (Mo-MO 2.69 A and 2.86 A) inspired in a deformed cube of S. Author

DATA SUMMARY: Density of rhombohedral Mo3S4; variables include density observed, density calculated, atomic parameters, distances and angles of atoms, distances from atoms to plane, intercluster distance of atoms, angle of slope; 5 tables include numeric data.

N77-14210# Sandia Labs., Albuquerque, N.Mex.
THERMAL PROPERTIES OF SOME MATERIALS USED IN IGNITERS
Merton M. Robertson Mar. 1976 30 p refs
(Contract AT(29-1)-789)
(SAND-76-0134) Avail: NTIS HC A03/MF A01

Thermal properties of materials similar to those used in headers, bridgewires, and charge holders for pyrotechnic devices are tabulated and plotted over temperature ranges of interest for device use and testing. The properties catalogued are heat capacity, thermal conductivity, density, and thermal diffusivity. ERA

DATA SUMMARY: Thermal property data for igniter materials are compared at ambient temperatures and at lowered and elevated temperatures; variables include thermal conductivity, specific heat capacity, density, diffusivity; 3 figures and 15 tables include numeric data.

N77-14211# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
APPLICATION OF PATCHES-3 TO THE THREE-DIMENSIONAL RESPONSE OF LAMINATED COMPOSITE STRUCTURES
E. L. Stanton and L. M. Crain Nov. 1975 115 p refs
(Contract N62269-75-C-0438)
(AD-A026589) Avail: NTIS HC A06/MF A01 CSCL 13/13

A recently developed program for the stress analysis of general solids of composite material is applied in this study to a sandwich panel impact problem and a partially cracked laminate problem. Objectives of the study are: (1) to determine the load distribution, the stresses and the deformations in individual plies of these composite laminates and (2) to demonstrate the modeling capabilities and limitations of the PATCHES-3 program. Preparatory to the analyses, the program was updated to automate the superposition of symmetry - asymmetry subcases for more efficient modeling. The present application of the PATCHES-3 system to laminated composites was successful in predicting the three-dimensional response of individual plies at very reasonable modeling and computational costs. Engineering checks of the overall response with hand calculations using beam and plate models were in good agreement for both the sandwich panel and the partially cracked laminate. A modeling error in the boundary conditions for the latter problem introduced fictitious normal forces for the asymmetry subcase. These forces were evaluated when the error was discovered and found to be small, on the order of 0.015 lbs maximum, and judged not to have a significant effect on the redistribution of load around the crack. The constraint force calculations were made possible by a postprocessor data file system developed as one of the objectives of the effort. The experience gained from the present study also indicates the need for improvement in certain areas. GRA

DATA SUMMARY: Diverse data are presented; variables are acceleration, stress distribution, time, field length, shear stress, strain contours, stress contours, stress components, deformation, bending moment.

N77-14212# Avco Corp., Lowell, Mass. Systems Div.
EXPLORATORY DEVELOPMENT AND EVALUATION OF LOW COST BORON ALUMINUM COMPOSITES Final Technical Report, Mar. 1974 - Aug. 1975
Val Krukonis, Albert W. Hauze, and Frank Wawner Nov. 1975 101 p refs
(Contract F33165-74-C-5082; AF Proj. 7351)
(AD-A027069; AFML-TR-75-187) Avail: NTIS HC A06/MF A01 CSCL 11/4

One inch wide monolayer boron-aluminum cast tape was successfully fabricated by passing collimated nitrided boron through molten aluminum. This process appears economically quite attractive in that cost projections for fabricating 20,000 lbs of tape per year are approximately $20 per pound exclusive of the cost of fiber and $76 per lb including the cost of fiber. Although cast nitrided boron-aluminum tape composites still have technical problems in providing adequate transverse strength simultaneously with good longitudinal strength retention, the cast tape process still appears to have merit for consideration with other less reactive fibers or for producing lower strength boron-aluminum at considerably lower cost than diffusion bonded material. Although the cost of production quantities of boron-aluminum green tape for diffusion bonding will probably be

comparable to that for cast tape, the latter has a distinct cost advantage in terms of low pressure (vacuum bag only) secondary fabrication with attendant lower pressure, cycle time, and tooling cost. The nitrided boron is produced by first oxidizing the fiber surface, then converting the oxide to a nitride. Because boron nitride does not bond readily to aluminum, there is a delicate balance required to obtain sufficient fiber-matrix reaction to provide a reasonable bond, but not so much as to significantly degrade the fiber properties. The nitrided boron was found to exhibit 30% higher strength than unnitrided boron and retain its strength better when subjected to high temperature exposure. This resistance to several thermal environments allows the cost boron-aluminum tape to be fabricated into structures at 1,220 F using vacuum bag pressure only. GRA

DATA SUMMARY: Tensile strength of coated and surface treated boron filaments; variables are tensile tests, tensile strength, heat treatment temperature, nitrided boron, aluminized nitrided boron, aluminized boron, drawing rate, diffusion bonding, production costs; 7 figures and 6 tables include numeric data.

N77-14213# Goodyear Aerospace Corp., Litchfield Park, Ariz.
ENVIRONMENTAL RESISTANCE OF COATED AND LAMINATED POLYCARBONATE TRANSPARENCIES Final Technical Report, Nov. 1973 - Jul. 1975
Richard A. Huyett and Glenn E. Wintermute Mar. 1976 150 p
(Contract F33615-74-C-5005; AF Proj. 7381)
(AD-A026412; GERA-2119; AFML-TR-76-24) Avail: NTIS HC A07/MF A01 CSCL 01/3

This report covers a program conducted to assess the environmental resistance characteristics of selected coated polycarbonate and acrylic/interlayer/polycarbonate composite aircraft windshield materials when exposed to aggressive laboratory accelerated and outdoor environmental testing. Author (GRA)

DATA SUMMARY: Diverse data are presented; variables include weathering, humidity, thermal resistance, ultraviolet radiation, fracture toughness, shear modulus, tensile strength, light transmission, haze.

N77-14214# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Ground Equipment/Materials Directorate.
QUANTIFICATION OF FLAWS IN FIBERED COMPOSITE STRUCTURES USING INTERFEROMETRIC FRINGE PATTERNS
B. R. Mullinex, W. F. Ranson (Auburn Univ., Ala.), W. F. Swinson (Auburn Univ., Ala.), and T. L. Cost (Ala. Univ., University) 20 Apr. 1976 95 p refs
(AD-A026871; RL-76-18) Avail: NTIS HC A05/MF A01 CSCL 14/2

This study concerns the nondestructive detection and quantification of flaws and voids in thin, cylindrical, fiber reinforced, composite, structures. Three different types of flaws were investigated using real-time and double exposure optical holography, and Young's Fringe method of speckle interferometry. The theory for each technique and photographs of the fringe patterns are presented. The fringe density plots were made by both manual and computer methods, and the flaw sizes were determined. The displacements and strains were computed. A computer program using conventional finite elements was used to theoretically compute the displacements near the border of the flaws. A new crack tip element was suggested to improve the results in the region of the flaw border. The results show that flaws in their fiber reinforced composite structures can be detected and the size determined by either optical holographic or speckle interferometric techniques. Author (GRA)

DATA SUMMARY: Surface deformation of complex cylinder with a spot flaw with 10 psig internal pressure: variables are fringe order, angular coordinate, radial displacement, axial displacement, grid location, distance relative to centerline, axial coordinate relative to flaw centerline; 8 figures include numeric data.

N77-14107# Universite Catholique de Louvain (Belgium). Lab. de Metallurgie Physique.
REVIEW OF COMPOSITE MATERIALS
A. Berghezan *In* ESA Mater. Sci. in Space Sep. 1976 p 351-364 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14110# Technische Univ., Berlin (West Germany). Inst. fuer Metallforschung und Metallkunde.
RESULTS OF WETTING-BEHAVIOUR STUDIES
K. Loehberg *In* ESA Mater. Sci. in Space Sep. 1976 p 375-380 refs Sponsored by DFVLR (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14111# Technische Universitaet, Clausthal-Zellerfeld (West Germany).
MELTING OF A PbAgBaO-POWDER ALLOY IN A ZERO-GRAVITY ENVIRONMENT (ROCKET FLIGHT)
W. Heye and M. Klemm *In* ESA Mater. Sci. in Space Sep. 1976 p 381-390 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N77-14215 Polish Academy of Sciences, Warsaw.
PHOTOCHEMICAL GRIDDING OF POLYETHYLENE [SIECIOWANIE FOTOCHEMICZNE POLIETYLENU]
K. A. Kunert, A. Gebka-Kozluk, J. Ranachowski, and J. Rzeszotarska 24 Jan. 1976 17 p refs In POLISH
Avail: Issuing Activity

The basic characteristics of polymers which are used in electrical systems (omitting special peculiarities such as semiconductivity, photosensitivity, and piezoelectricity) are high dielectric strength, cross-resistivity, resistance to ageing, high working temperature, chemical durability and incombustibility. The easiest method of obtaining polymers with these optimal characteristics is modification of polymers presently produced. One of the methods of modification of polyethylene which is now widely used is gridding. Photochemical gridding is a rational method of obtaining gridded polyethylene. This method is discussed in detail. Photochemical gridding utilizes mercury vacuum and medium pressure lamps. The photosensitizers used include: benzophenone, certain ketones, aldehydes, aromatic hydrocarbons, chlorinated hydrocarbons, acidic chlorides, and other compounds. Author

N77-14216 Rhode Island Univ., Kingston.
A DEPOLARIZED RAYLEIGH LIGHT SCATTERING STUDY OF SOME UNSATURATED IONS AND MOLECULES IN SOLUTION: THE EFFECT OF SUPPORTING ELECTROLYTE ON AQUEOUS SOLUTION MOLECULAR OPTICAL ANISOTROPIES AND A STRUCTURAL STUDY OF SOME DIORGANOTIN (4) COMPLEXES IN BENZENE OR CYCLOHEXANE SOLUTION Ph.D. Thesis
Neil Joseph Asting, Jr. 1976 165 p
Avail: Univ. Microfilms Order No. 76-25528

Experimental molecular optical anisotropies were determined for several planar unsaturated bidentate ligands. Since it was fairly certain that these molecules should possess large optical anisotropies, bond and group polarizability additivity calculations indicated that upon chelation of two of these ligands with an appropriate metal, it would be fairly simple to relate depolarized light scattering intensities to the geometry of the complex containing these ligands. Simply, depolarized scattered light intensities will be related to angle between the two chelate rings. To investigate this hypothesis several tin(4) complexes of

the type R2SnCH2 (R = methyl or ethyl, Ch-1 = bidentate ligand anion) were synthesized. The structures of these complexes were then interpreted by comparing the molecular optical anisotropies of the complexes with those of their corresponding ligands. Dissert. Abstr.

N77-14217 Illinois Univ., Urbana.
AN AUTOMATED ARC/FLAME SPECTROMETER SYSTEM Ph.D. Thesis
Terry Alaric Woodruff 1976 236 p
Avail: Univ. Microfilms Order No. 76-24210

A computer-controlled, automated instrument has been developed which employs a programmed arc/flame atom reservoir for encoding sample elemental composition as electromagnetic radiation via atomic emission (AE) and fluorescence (AF). It partially overcomes, at relatively low cost, many of the problems found in methods using a flame or electrical discharge alone. The new source combines a low temperature diffusion flame, and a precise liquid sample nebulization device, with a highly stable, programmed dc arc as an efficient atomizer and excitation source. Results with a precision of better than 1% can be routinely achieved; improved excitation can provide AE sensitivities for hard-to-excite elements of two orders of magnitude better than those obtained with a flame alone. Efficient atomization virtually eliminates atomization interferences in AE analyses for the systems studied. Dissert. Abstr.

N77-14218 British Library Lending Div., Boston Spa (England).
PRESERVING DISPERSIONS AND DISPERSION PAINTS
K. H. Wallhaeuser and W. Fink Jul. 1976 44 p Transl. into ENGLISH from Farbe und Lack, v. 2, no. 82, 1976 p 108-125 (BLL-RTS-10271) Avail: British Library Lending Div., Boston Spa, Engl.: £10.00; 13 BLL overseas or 39 UK BLL photocopy coupons

A general review of the origins of microorganisms is given along with a discussion of preservatives. Various factors affecting the action spectrum of a preservative are discussed and appropriate use concentrations given in tables. It is shown how, using simple laboratory methods, the preservative action of various substances in a dispersion or in a finished product can be tested. Author

N77-14219 British Library Lending Div., Boston Spa (England).
CATALYTIC PROPERTIES ON STANNIC (IV) OXIDE SUPPLEMENTS WITH CHROMIC (III) OXIDE
Solymosi Frigyes, Hesz Arpad, and Bozso Ferenc Jul. 1976 16 p refs Transl. into ENGLISH from Magy. Kem. Folyoirat (Hungary), v. 81, no. 2, 1975 p 81-86
(BLL-RTS-10140) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; BLL overseas or 21 UK BLL photocopy coupons

The incorporation of a small proportion, 0.01-1 mole-%, of chromic oxide in the lattice of stannic oxide was studied using electrical conductivity measurements and determining specific surface. It is shown that in parallel with the incorporation of chromium, some chromium (III) ions are oxidized to a higher valence. Oxidation of chromium (III) ions starts above 400 C and is maximum at 700 C. Results of SnO2+1%Cr203 calcined at different temperatures are given. Author

N77-14220 British Library Lending Div., Boston Spa (England).
HYDROGENATING AND DEHYDROGENATING CATALYSTS
Franz-Josef Broecker and Knut Kaempfer [1976] 20 p refs Transl. into ENGLISH from Chemie. Techn., (West Germany), v. 47, no. 12, 1976 p 513-522
(BLL-M-24811-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The theoretical aspects of catalytic hydrogenation are discussed. The development of hydrogenating and dehydrogenating catalysts are described for large-scale industrial production of chemical products. Topics treated include hydrogenation of unsaturated compounds, dearomatization, CO-hydrogenation, the preparation of amines from nitriles and aromatic nitro-compounds, dehydrogenation and dehydrocyclization of paraffins, styrene production, and the hydrogenation of alcohol. Author

N77-14221# Tokyo Univ. (Japan). Dept. of Jet Propulsion.
SUPERSONIC COMBUSTION OF HYDROGEN IN A VITIATED AIRSTREAM USING TRANSVERSE INJECTION
Akira Yoshida and Hiroshi Tsyji 11 Jan. 1977 39 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in April 1977
Avail: NTIS HC A03/MF A01

The ignition and combustion of hydrogen in the Mach 1.81 supersonic vitiated airstream were investigated. Highly underexpanded hydrogen and nitrogen jets were injected from a converging slot nozzle perpendicular to airstream. Temperatures and oxygen concentrations of the vitiated airstream, and injection pressures were varied, including conditions at which hydrogen jet ignited spontaneously. Temperature profiles and pitot pressure profiles were measured on combustion flowfield. Ignition of hydrogen occurred in the upstream separated region, and after the small induction zone the turbulent diffusion flame was formed in the mixing region between the supersonic airstream and injected hydrogen. Chemical reaction in the upstream separated region increased the separation distance significantly. Author

N77-14222*# Kanner (Leo) Associates, Redwood City, Calif.
CARBON BLACKS EXAMINED BY ELECTRON PARAMAGNETIC RESONANCE
A. Charlier and P. Taglang Washington NASA Dec. 1976 11 p refs Transl. into ENGLISH of J. Chim. Phys. (Paris), v. 63, no. 4, 1966 p 572-576
(Contract NASw-2790)
(NASA-TT-F-17324) Avail: NTIS HC A02/MF A01 CSCL 07D

The hyperfrequency properties of two series (HAF and MPC) of carbon blacks, oxidized by O3 or HNO3, were studied by means of a 9-kMc EPR spectrometer. The atmospheric oxygen from the oxidizer creates new centers. Author

N77-14223*# Kanner (Leo) Associates, Redwood City, Calif.
KINETIC STUDY OF GRAPHITIZATION. 1: MAGNETIC
M. Mazza Washington NASA Dec. 1976 19 p refs Transl. into ENGLISH of J. Chim. Phys., v. 61, no. 5, 1964 p 721-728
(Contract NASw-2790)
(NASA-TT-F-17329) Avail: NTIS HC A02/MF A01 CSCL 07D

The kinetics of the isothermal transformation of an amorphous asphalt coke into graphitized carbon was studied between 1,400 and 3,000 deg by means of changes in the diamagnetic susceptibility, x. X changed almost linearly with heat treatment between 1,400 and 2,000 deg. Above 2,000 deg, x reached a constant value. Author

N77-14224*# Kanner (Leo) Associates, Redwood City, Calif.
ELECTRON PARAMAGNETIC RESONANCE STUDY OF TARS PRODUCED BY RAPID PYROLYSIS
R. Chauvin, P. Chiche, M. F. Quinton, and J. Uebersfeld Washington NASA Dec. 1976 24 p refs Transl. into ENGLISH of Carbon (France), v. 7, no. 2, 1969 p 307-318
(Contract NASw-2790)
(NASA-TT-F-17336) Avail: NTIS HC A02/MF A01 CSCL 07D

The electron paramagnetic of coals and of the corresponding tars produced by rapid pyrolysis and trapped at 100 K in the resonant cavity of a spectrometer was studied. The ESR signal was resolved into a broad and a narrow line. The paramagnetic centers responsible for the narrow line are essentially located in inertinite. The width of the broad line increases from vitrinite to exinite. The tars have a larger proportion of aliphatic compounds than the original coal. This replenishment seems to be related to the complex depolymerization and repolymerization reactions during rapid pyrolysis. When the tars are reheated from 100 to 400 K, the free radicals gradually disappear. Author

N77-14225# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
ELECTRODE MECHANISMS USING REFLECTION AND ELECTRON SPECTROSCOPY Final Report, 15 Jan. 1972 - 14 Jan. 1976
Nicholas Winograd Jun. 1976 29 p refs
(Grant AF-AFOSR-2238-72; AF Proj. 9536)
(AD-A027694; AFOSR-76-0856TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

The general objectives of our AFOSR research have emphasized the development of various spectroscopic methods in characterizing electrochemical reactions mechanisms. The reason for exploring spectroscopic methods for investigating electrode processes stemmed from a general lack of progress from monitoring the relatively unspecific parameters of current, potential and charge. To date, these studies have involved the development of the internal reflection spectroscopic (IRS) technique at optically transparent electrodes (OTE's) to monitor in situ surface electrode reactions. Reflection changes induced both by the diffusion of light absorbing species in solution, and by the alteration of the optical constants associated with the formation of electrode films have been observed. In addition, we initiated in 1971 the first experiments utilizing electron spectroscopy for chemical analysis (XPS or ESCA) for identifying the nature of surface films. Since that time we have been concerned with developing XPS as a mechanistic aid in following electrode reactions, primarily those where surface oxide films alter the electronic properties of the electrode surface.
Author (GRA)

N77-14226# Case Western Reserve Univ., Cleveland, Ohio. Electrochemistry Research Lab.
MECHANISMS OF ELECTROCHEMICAL REACTIONS ON NON-METALLIC SURFACES
Ernest Yeager 1 Feb. 1976 29 p refs
(Contract N00014-75-C-0953; NR Proj. 359-451)
(AD-A027525; TR-44) Avail: NTIS HC A03/MF A01 CSCL 07/4

Oxygen electrocatalysis has assumed new importance because of the involvement of the O2 electrode in various fuel cells and electrolyzer systems. For O2 electroreduction to proceed at reasonable current densities requires the adsorption of the O2 molecule or ion on the electrode surface. Various models for the interaction of such O2 species with surfaces and the corresponding pathways for the electro-reduction are considered. Generally peroxide mechanisms are predominant in aqueous solutions on non-metallic as well as metal surfaces, but this leads to less favorable operating potentials for O2 cathodes. A number of reasonably effective O2 electroreduction catalysts have been identified for alkaline solutions, but so far only high area platinum appears to combine reasonable activity and stability in acid electrolytes. Various electrocatalysts for which results have been reported in the literature are summarized. The electrochemical behavior of various carbons and graphites, lithiated NiO and various defect metal oxides including RuO2/Ti is considered in some detail relative to O2 generation as well as reduction kinetics. GRA

N77-14227# California Univ., Berkeley. Lawrence Berkeley Lab.
LEED, AES AND THERMAL DESORPTION STUDIES OF CHEMISORBED HYDROGEN AND HYDROCARBONS (C2H2, C2H4, C6H6, C6H12) ON THE (111) AND STEPPED [6(111)TIMES (100)] IRIDIUM CRYSTAL SURFACES COMPARISON WITH PLATINUM Interim Report
B. E. Nieuwenhuys (Gorlaeus Lab., Leiden, the Netherlands), D. I. Hagen (Union Carbide Labs., South Charleston, W. Va.), G. Rovida (Inst. di Chimica Fisica, Univ. di Firenze, Italy), and G. A. Somorjai May 1976 44 p refs Submitted for publication Sponsored in part by ERDA
(Contract N00014-75-C-0890; NR Proj. 056-568)
(AD-A026400; LBL-4585) Avail: NTIS HC A03/MF A01 CSCL 07/4

The adsorption of hydrogen, ethylene, acetylene, cyclohexane and benzene was studied on both the (111) and stepped (6(111)x(100)) crystal surfaces of iridium. The techniques used were low-energy electron diffraction, Auger electron spectroscopy and thermal desorption mass spectrometry. No indication for ordering of the carbonaceous residue was found on the stepped iridium surface in these experiments. The hydrocarbon molecules form only poorly ordered surface structures on both iridium surfaces when the adsorption is carried out at 30 C. The hydrogen desorption spectra from the iridium surfaces exposed to C2H4, C2H2 or C6H6 exhibit two hydrogen desorption peaks, one around 200 C and the second around 350 C. The relative intensities of these two peaks depend strongly on the surface used. Arguments are presented that decomposition of the hydrocarbon molecules (C-H bond breaking and possibly also C-C bond breaking) occurs easier on the stepped iridium surface than on the (111) surface. The results are compared with those obtained previously on similar crystal surfaces of platinum. It appears that C-H bond breaking occurs more easily on iridium than on platinum. GRA

N77-14228# Maine Univ., Orono. Dept. of Physics.
SOME ELECTRICAL PROPERTIES AND ORDERING IN THE P-N-ALKOXYBENZOIC ACIDS
E. F. Carr 1975 15 p refs Repr. from Pramana, suppl. no. 1, 1975 p 263-275 Submitted for publication
(Grant DA-ARO-D-31-124-G135)
(AD-A026502; ARO-7612.12-P) Avail: NTIS HC A02/MF A01 CSCL 07/4

The work discussed here involves the p-n-alkoxybenzoic acids, propyloxy-through nonyloxy-benzoic acid. Much of the discussion is concerned with a review of earlier work on p-n-butyloxy and p-n-nonyloxybenzoic acid. Some preliminary results are presented on other benzoic acids, and results on other materials are discussed in so far as they relate to the benzoic acids. The p-n-alkoxybenzoic acids exhibit some unusual changes in dielectric properties at transition temperature, and these are explained by assuming an abrupt change in concentration of the monomer at the transition. The conductivity anisotropy exhibits some unusual behavior in the nematic phase, and this is explained by assuming the existence of hydrogen-bonded clusters as well as a cybotactic structure involving dimers. Author (GRA)

N77-14229# California Univ., San Diego. Dept. of Chemistry.
MOLECULAR DYNAMICS AND PHOTOFRAGMENT SPECTROSCOPY Final Technical Report, 1969 - 1975
Kent R. Wilson Oct. 1975 35 p refs
(Contract N00014-69-A-0200-6020)
(AD-A026572) Avail: NTIS HC A03/MF A01 CSCL 07/4

During our contract period with the office of Naval Research, we have developed, perfected and applied a new form of molecular spectroscopy to study elementary photodissociation processes. We call this technique photofragment spectroscopy. A beam of molecules is crossed orthogonally with a pulsed beam of photons in a high vacuum, essentially collision free, environment. The molecular fragments resulting from the photon absorption are detected by a time of flight mass spectrometer which is normal to the plane of the molecular and photon beams. The nature of the recoiling fragments may be determined from their mass spectra. By measuring the time taken by each kind of fragment to traverse the known path length to the detector, and using energy and momentum conservation, the energetics of the photodissociative process may be determined. The angular distribution of the recoiling fragments provides information on the symmetry of the excited molecular state, and on the lifetime and molecular dynamics of the dissociating molecule. GRA

N77-14230# Kentucky Univ., Lexington.
GAS ADSORPTION BY ACTIVATED AND IMPREGNATED CARBONS Quarterly Status Report, 9 Jan. - 8 Apr. 1976
P. J. Reucroft and C. P. Madhusudhan Jun. 1976 23 p refs
(Contract DAAA15-74-C-0163; DA Proj. 1W7-62710-A-095)
(AD-A026720; EC-CR-76083; QSR-8) Avail: NTIS HC A02/MF A01 CSCL 07/4

In the period reported, equilibrium adsorption isotherms have been measured for CHC13 and CC14 on BPL activated carbon and for CC14 on carbons 1, 2, 3. The results have been analyzed in terms of the Dubinin-Polanyi isotherm equation. The W sub 0 and k parameters for carbons 1 and 3 compare with BPL activated carbon. The W sub 0 and k parameters are significantly larger than those for BPL activated carbon in the case of carbon 2.
Author (GRA)

N77-14231# Harry Diamond Labs., Adelphi, Md.
A POSSIBLE USE OF THE SURFACE STATES OF TRANSITION AND RARE-EARTH METAL IONS IN THE THEORY OF CATALYSIS
Clyde A. Morrison, Nick Karayianis, and Donald E. Wortman Apr. 1976 14 p refs
(DA Proj. 1T1-61102-AH-44; HDL Proj. A44632)
(AD-A026547; HDL-TR-1752) Avail: NTIS HC A02/MF A01 CSCL 20/10

A very brief and concise approach to the theory of heterogeneous catalysis is presented. The theory, as given, is in very rough stages; nevertheless, the theory has certain unique benefits. The approach given here is to include the contribution of the unfilled electron shell to the potential near the metal surface. A particular example is calculated for the various states of Pr(3-) in PrSb for a (100) surface. Author (GRA)

N77-14232# Kentucky Univ., Lexington.
GAS ADSORPTION BY ACTIVATED AND IMPREGNATED CARBONS Quarterly Status Report, Oct. 1975 - Jan. 1976
P. J. Reucroft and C. T. Chiou May 1976 27 p refs
(Contract DAAA15-74-C-0163; DA Proj. 1W7-62710-A-095)
(AD-A026762; EC-CR-76077; QSR-7) Avail: NTIS HC A03/MF A01 CSCL 07/4

In the period reported, equilibrium adsorption isotherms have been measured for hydrogen cyanide on BPL grade activated carbon, ASC whetlerite, and two ASB impregnated carbons. The results have been analyzed in terms of the Dubinin-Polanyi isotherm equation. Adsorption components due to chemisorption and physical adsorption have been separated. GRA

N77-14233# California Univ., Irvine. Dept. of Chemistry.
PHOTO-EXCITED CHEMILUMINESCENCE SPECTROSCOPY: DETECTION OF HYDROGEN-ATOMS PRODUCED FROM SINGLE VIBRONIC LEVEL PHOTOLYSIS OF FORMALDEHYDE (A1A2) Interim Report, 1 Apr. 1976 - 31 Mar. 1977
Roger S. Lewis, Kenneth Y. Tang, and Edward K. C. Lee 10 Jul. 1976 9 p refs Presented at the Natl. Meeting of the Am. Chem. Soc., San Francisco, 30 Aug. - 3 Sep. 1976
(Contract N00014-75-C-0813; NR Proj. 014-506)
(AD-A026878; B-7) Avail: NTIS HC A02/MF A01 CSCL 07/4

A sensitive and quantitative spectroscopic method of detecting the hydrogen atoms formed in photolysis has been developed. The near infrared emission from HNO produced by recombination of H and NO is monitored. GRA

N77-14234# Cornell Univ., Ithaca, N.Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION 3. THE FLAME OF A LINEAR CONDENSATE
Geoffrey S. S. Ludford Jun. 1976 35 p refs
(Grant DAAG29-76-G-0026; ARO Proj. 12373-M)
(AD-A027439; TR-82; ARO-12373.22-M) Avail: NTIS HC A02/MF A01 CSCL 21/2

The present series of Technical Reports (of which nos. 77 and 80 were the first two) will give a connected account of laminar combustion from the viewpoint of activation energy asymptotics. The present report is concerned with the simplest, realistic one-dimensional problem of combustion: To determine the conditions under which there is a steady flame when the reactants are produced at the surface of a solid or liquid. In contrast to earlier treatments, these conditions are clearly uncovered by the asymptotic analysis, which leads to several unsuspected phenomena. Account is taken of radiative exchange between the surface and its surroundings as well as distributed heat loss. Author (GRA)

N77-14235# Watervliet Arsenal, N.Y. Benet Weapons Lab.
CHEMICALLY VAPOR DEPOSITED TUNGSTEN COATINGS FOR EROSION PROTECTION
R. W. Haskell and A. R. Imam 1976 15 p refs
(AD-A026039) Avail: NTIS HC A02/MF A01 CSCL 19/6

Erosion resistant, chemically vapor deposited tungsten coatings can be applied to steel at temperatures below the tempering temperature. A nickel inner layer is used to promote adherence. These coatings increase the erosion life of steel by at least a factor of ten; however, because of the high thermal conductivity of tungsten they increase the heat absorption. Their resistance to thermal fatigue can be improved by refining the columnar grain structure. The tungsten coatings may be significantly improved by an addition of silicon introduced as silane in the reactant gas mixture. The resultant silicon-alloyed tungsten coating is fine grained, has a lower thermal conductivity and hence lower heat absorption, and may be applied at much lower temperatures. GRA

N77-14236# Naval Civil Engineering Lab., Port Hueneme, Calif.
SCATTERED-LIGHT PHOTOELASTIC ANALYSES OF TUNNEL INTERSECTIONS AND A VLF HOLLOW-POST INSULATOR Final Report, Jul. 1973 - Jan. 1975
G. Warren Apr. 1976 33 p refs
(ZF61512001)
(AD-A026198; CEL-TR-842) Avail: NTIS HC A03/MF A01 CSCL 14/2

A scattered-light photoelastic stress analysis was performed on models of a VLF hollow-post insulator and a tunnel intersection configuration. A scattered-light polariscope was designed and fabricated in order to perform the analysis. Stress concentrations were found to be more than two times the applied loading in the insulator model and four times the applied loading in the tunnel intersection model. Except for special instances, the conventional three-dimensional photoelastic technique is still more practical for photoelastic applications in small laboratory studies. GRA

N77-14237# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. Fuels and Lubricants Div.
OXYGEN FLASK METHOD FOR DETERMINING ELEMENTS IN OILS: AN EVALUATION Final Report
Marjan Kolobielski Feb. 1976 17 p refs
(DA Proj. 1F6-62611-AH-69)
(AD-A027099; USAMERDC-2165) Avail: NTIS HC A02/MF A01 CSCL 14/2

The oxygen flask, combustion technique for determining phosphorus, sulfur, and chlorine in oils was evaluated using military lubrication oils as representative material. The concentration of those elements, after combustion of the samples, was determined spectrophotometrically. This technique is a rapid, simple, and inexpensive method for performing nonroutine analysis. GRA

N77-14079# Max-Planck-Institut fuer Biochemie, Martinsried bei Muenchen (West Germany).
DETAILED RESULTS OF ASTP EXPERIMENT MA-014 (CONTINUOUS-FLOW ELECTROPHORESIS)
K. Hannig and H. Wirth *In* ESA Mater. Sci. in Space Sep. 1976 p 135-140 (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14080# Case Western Reserve Univ., Cleveland, Ohio.
THE INFLUENCE OF CONVECTION IN CONTINUOUS-FLOW ELECTROPHORESIS
S. Ostrach *In* ESA Mater. Sci. in Space Sep. 1976 p 141-147 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N77-14238 Fordham Univ., New York.
PERCHLORATO COMPLEXES OF ALKALI METALS Ph.D. Thesis
Diana D. Cavalluzzo 1976 87 p
Avail: Univ. Microfilms Order No. 76-25717

The structures of two perchlorato complexes of alkali metals were determined using data collected on the CAD-4 automated diffractometer. Both structures were determined by the heavy atom method and refined anisotropically by block-diagonal least squares. Bis(diacetamide)(perchlorato) sodium(I) and sesqui (acetamide)(diacetamide)(perchlorato)lithium(I) were studied. Dissert. Abstr.

DATA SUMMARY: Data Summary not prepared due to nonavailability of complete document for processing.

N77-14239 Princeton Univ., N.J.
SURFACE PHOTOEMISSION AND THE OPTICAL PROPERTIES OF DISORDERED METALS Ph.D. Thesis
Peter Charles Colter 1976 76 p
Avail: Univ. Microfilms Order No. 76-23822

There are two mechanisms for photoemission - surface and

volume. In volume photoemission, the photons are absorbed in the bulk of the material, and the excited electrons diffuse out. The photoemission dependence on polarization and angle of incidence is thus the same as that of the optical absorption under these conditions. Surface photoemission is due to the boundary of the electron gas at the surface. Experimentally, it appears as a polarization dependence in the photoemission; that is, P polarized light uniquely excites it. The principal part of the surface photoemission work was an experiment on sodium. In this case, a sodium film was evaporated onto a sapphire substrate at liquid nitrogen temperature where the photoemission shows a large enhancement believed to be due to photoemission from surface plasmon oscillations coupled through surface disorder.
Dissert. Abstr.

DATA SUMMARY: Data Summary not prepared due to nonavailability of complete document for processing.

N77-14240 Princeton Univ., N.J.
A NEW MEASUREMENT OF THE CRITICAL EXPONENT BETA IN NICKEL Ph.D. Thesis
John David Cohen 1976 145 p
Avail: Univ. Microfilms Order No. 76-25103

The transmission of microwaves at a frequency of roughly 9.2 GHz through thin foils of nickel is studied as a function of temperature near the critical point. In particular, in zero applied field a strong peak in the transmitted power is observed as the temperature is varied over a regime just below TC. A theory for this zero field resonance is developed which, in fact, shows how the transmitted power can be related directly to the spontaneous magnetization in the nickel. This may then be used to deduce the critical exponent beta describing the variation of magnetization with temperature. In addition, a study is made of the transmission resonance line shape obtained by applying a perpendicular magnetic field at fixed temperature for a variety of temperatures in the critical regime. Dissert. Abstr.

DATA SUMMARY: Data Summary not prepared due to nonavailability of complete document for processing.

N77-14241 Stanford Univ., Calif.
THE STRUCTURE AND PROPERTIES OF ALUMINA-DISPERSED COPPER PREPARED BY HIGH RATE PHYSICAL VAPOUR DEPOSITION Ph.D. Thesis
Kumar Sankar Majumder 1976 119 p
Avail: Univ. Microfilms Order No. 76-26033

Dual source electron beam heating was employed to evaporate OFHC copper and high purity alumina. The vapors are intermixed and then condensed on a stationary preheated substrate to produce the thick film. Fully dense deposits (up to 0.2 cm thick) with a very fine dispersion of the oxide phase (particle size less than 50 A) were obtained at deposition rates of about 4,000 A/sec. Glass and metallic substrates with various surface roughnesses were used. The substrate temperature and the evaporation rates for the two sources were varied. The microstructure and surface topography were characterized, crystallographic texture was studied, and composition and thickness profiles were determined. Dissert. Abstr.

DATA SUMMARY: Data Summary not prepared due to nonavailability of complete document for processing.

N77-14242 National Lending Library for Science and Technology, Boston Spa (England).
METAL PHYSICS: STRUCTURAL ANALYSIS OF MOLTEN METALS CARRIED OUT ON THE BASIS OF INVESTIGATING THE DISCRETE NATURE OF CHANGES IN PHYSICAL PROPERTIES
E. S. Filippov 1976 16 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii (USSR), no. 1, 1976 p 121-126
(NLL-M-25385-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Within the range of the theory developed for molten metals, based on the idea of spherical groupings which are eroded by type of melting, the coordination number (K) was calculated for 22 metals on the basis of the type of packing in groupings (K sub sol.) and the statistical packing (K sub s.p. 6.5-4.5). The diffraction number K is represented as being a total consisting of K sub sol. for the groupings and K sub s. p. The type of packing in the groupings (K sub sol.) is established in the experiments from investigation of the density-temperature relationship causing stage (discrete) change density. The relationship of the temperatures at the start and end of a stage is equal to the packing coefficient in a grouping (0.74, 0.68, 0.50). Author

DATA SUMMARY: Relationship of the factors affecting the formation of various packing groupings in molten metals and the diffraction number; variables are volume, temperature, mean diffraction number, calculated diffraction number, simple cubic packing, body-centered cubic packing; 2 figures and 1 table include numeric data.

N77-14243 National Lending Library for Science and Technology, Boston Spa (England).
METAL PHYSICS: STABILITY OF THE PROCESS OF SOLIDIFICATION OUT OF MOLTEN METAL
V. A. Tatarchenko and E. A. Brener 1976 15 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii (USSR), no. 1, 1976 p 140-144
(NLL-M-25387-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Thermal and capillary conditions providing a stable solidification process in extraction from a molten substance are investigated. Author

DATA SUMMARY: No numeric data are presented.

N77-14244 British Library Lending Div., Boston Spa (England).
A THEORETICAL STUDY OF CARBIDE AND CHROMIUM DEPLETED LAYER IN AUSTENITIC STAINLESS STEEL
H. Arai 25 May 1976 21 p refs Transl. into ENGLISH from J. Iron Steel Inst. (Japan), v. 56, no. 1, 1970 p 44-54
Avail: British Library Lending Div., Boston Spa, Engl.

The rate controlling mechanism of carbide precipitation in austenitic stainless steel is discussed. Theoretical calculations are presented of the decrease in chromium concentration at the grain boundary, and rate of carbide precipitation from various numerical data for diffusion. The results of the theoretical analysis are compared with existing literature on intergranular corrosion to develop a unified interpretation of the TTS (time-temperature-sensitization) curve. Author

DATA SUMMARY: Diffusion-based theoretical analysis of carbide precipitation and change in intergranular chromium concentration in austenitic stainless steel; variables are diffusion coefficients, corrosion rate, time-temperature-sensitization, intergranular corrosion index; 12 figures and 3 tables include numeric data.

N77-14245 British Library Lending Div., Boston Spa (England).
INITIATION OF CRACKS AND RATE OF FATIGUE. CRACK PROPAGATION OF A NUMBER OF AUSTENITIC STAINLESS STEELS
P. Rabbe et al 4 Mar. 1976 20 p refs Transl. into ENGLISH from Rev. Met. (Paris), Dec. 1974 p 931-941
(BLL-CE-Trans-6764-(9022.09)) Avail: British Libraries Lending Div., Boston Spa, Engl.

Various fatigue tests were carried out on 18-10 or 18-12 Mo austenitic stainless steels. Repeated tensile tests were made at either ambient temperature or at 320 C; the tests dealt with the following points: determining the number of cycles necessary to produce fatigue cracking as a function of the angle of the mechanical notch; determining the Paris law of coefficients; and investigating the fatigue crack propagation threshold. Conclusions are presented. Author

DATA SUMMARY: Fatigue crack growth rate curves of austenitic stainless steels; variables are stress intensity factor, number of initiation cycles at 320 C, number of initiation cycles at 20 C, notch radius, fatigue crack growth rate, chemical composition, mechanical properties; 13 figures and 5 tables include numeric data.

N77-14246 British Library Lending Div., Boston Spa (England).
A NUMERICAL ANALYSIS OF THE DIFFUSION AND TRAPPING OF HYDROGEN IN STEELS AND ITS APPLICATION TO WELDMENTS
K. Kohira, Takashi Yatake, and Nobutaka Yurioka 4 Mar. 1976 23 p ref Transl. into ENGLISH from Yosetsu Gakkaishi (Japan), vol. 43, no. 9, 1974 p 921-930
(BLL-CE-Trans-6800-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The foundations for a theoretical analysis of local hydrogen diffusion and accumulation in a steel weld are reported. The weld is subjected to plastic deformation from thermal welding stress and suffers a marked deterioration in toughness. A hydrogen diffusion accumulation model is advocated that is temperature dependent in relation to crack formation. G.G.

DATA SUMMARY: Hydrogen stress in steel weld embrittlement; variables are temperature dependence, thermal stress, diffusion coefficients, heat treatment, heat transfer, mass transfer, stress-strain-time relations; 15 figures contain numeric data.

N77-14247 British Library Lending Div., Boston Spa (England).
EFFECT OF SINTERING PRESSURE ON ONCE-SINTERED BARIUM FERRITES
H. Staeblein Sep. 1976 19 p refs Transl. into ENGLISH from Technische-Mitteilungen Krupp-Forschungsberichte (Essen), v. 33, no. 1, 1975 p 1-10
(BLL-RTS-10291) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas or 30 UK BLL photocopy coupons

The behavior of a once-sintered mixture of natural haematite and barium carbonate in compression and sintering is studied along with its magnetic characteristics. The quasi-isostatic forming pressure was varied between 1 and 26 kbar, and the sintering temperature was varied between 900 and 1,300 C. The relation between sintering behavior, structure, silicon dioxide and aluminium oxide additions, and magnetic properties is discussed. Author

DATA SUMMARY: The behavior of a high pressure formed mixture of haematite and barium carbonate subjected to compression and sintering; variables are formed density, sintered density, sintering temperature, compression function, remanence, polarization coercive field strength; 9 figures and 2 tables include numeric data.

N77-14248 Tennessee Univ., Knoxville.
THE EFFECTS OF ORIENTATION ON THE ROLLING AND RECRYSTALLIZATION BEHAVIOR OF TANTALUM SINGLE CRYSTALS Ph.D. Thesis
William Bryson Synder, Jr. 1976 228 p
Avail: Univ. Microfilms Order No. 76-24864

The recrystallization behavior of rolled single crystals was studied to determine the effects of texture diffuseness or sharpness, crystal reorientation, and deformation band formation. Optical and electron metallography, X-ray line broadening and pole figure analyses, and microhardness testing were used to study the deformed, recovered, and recrystallized structures of tantalum single crystals. Crystal stability, reorientation, and deformation banding were interpreted in terms of the Taylor theory of plasticity as applied to pencil glide in body-centered cubic metals. Recovery processes produced large, slightly misoriented subgrains in the stable crystals whose initial dislocation distributions were uniform. Natural recrystallization only occurred in crystals which contained dislocation cell structures after rolling. Nucleation of recrystallization was found to occur by the polygonization and growth of dislocation cells originally present in the deformed structure. Dissert. Abstr.

DATA SUMMARY: Data Summary not prepared due to nonavailability of complete document for processing.

N77-14249 Illinois Univ., Urbana-Champaign.
DESORPTION FROM ALUMINA POWDER SURFACES AS IT RELATES TO COMPACTION AND SINTERING Ph.D. Thesis
Carl Louis Eggerding 1976 122 p
Avail: Univ. Microfilms Order No. 76-24075

The desorption spectra of submicron alpha-alumina powders in the as-received state were measured using a mass spectrometer to characterize the adsorbates present on the surfaces. The surface adsorbates were then altered by ball-milling the powders in water, and hydrochloric, hydrofluoric, and sulphuric acid solutions having normalities of unity. The desorption spectra of powders treated in these media were measured. The compaction and sintering behavior of these powders were analyzed. Microstructural investigation of the sintered compacts was also performed. It was found that the temperature at which the maximum desorption rate of species from a powder surface occurred was a unique value for a specific powder. This was found for powders from different sources and for nominally-identical powders from different production lots. Dissert. Abstr.

DATA SUMMARY: Data Summary not prepared due to nonavailability of complete document for processing.

N77-14250# Royal Aircraft Establishment, Farnborough (England).
EFFECT OF INTERSPERSED PERIODS OF HEATING ON FATIGUE CRACK INITIATION AND PROPAGATION IN CM001 (RR58) CLAD SHEET
F. E. Kiddle Jul. 1976 33 p refs
(RAE-TR-76092; BR53901) Avail: NTIS HC A03/MF A01

Fatigue tests have been conducted to study the effect of interspersed periods of heating on the initiation and early growth of cracks from holes in clad sheet and also on later stages of crack propagation. The tests were under flight simulation loading, and the material was clad aluminum alloy sheet. Interspersed heating reduced the lives to initiate and grow cracks to 2mm, and this is attributed to the softening of strain hardened material at the crack tip, but no effect was observed for long crack lengths. When load was applied during the periods of heating creep redistribution of local stress retarded the growth of short and long cracks. Author

DATA SUMMARY: Crack formation in thermally stressed clad aluminum alloy sheet; variables are thermal stress, cyclic loads, creep strength, stress cycles, aerodynamic loads, stress-strain-time relations; 12 figures and 3 tables include numeric data.

N77-14251# Materials Research Labs., Melbourne (Australia).
DYNAMIC FRACTURE TOUGHNESS OF QUENCHED AND TEMPERED MILD STEEL
M. E. DeMorton 1976 10 p refs
(Paper-17) Avail: NTIS HC A02/MF A01

Using both COD and LEFM approach it is shown that the fracture toughness of quenched and tempered mild steel is markedly increased under dynamic loading conditions. The micromechanisms of brittle fracture under these conditions is by the formation and growth of voids. When the fracture mode is changed to cleavage by reducing the test temperature the normal reduction in fracture toughness under dynamic loading conditions is observed. In this material, which was heat treated to simulate a heat affected weld zone, the fracture toughness is further reduced by dynamic strain ageing above ambient, with the temperature for the roughness minima dependent on the strain rate. The fracture toughness measured in the fibrous fracture mode is enhanced by a low strain-hardening rate. The measurements were made using double notched and fatigue cracked Charpy-size specimens tested in an instrumented Charpy machine and a static rig. Author

DATA SUMMARY: Effects of heat treatment and dynamic loading conditions on fracture mode; variables include temperature, yield strength, tensile stress, elongation, load, elastic limit, strain hardening, fracture toughness, energy to fracture; 5 figures include numeric data.

N77-14252*# Little (Arthur D.), Inc., Cambridge, Mass.
DEVELOPMENT OF TECHNIQUES FOR PROCESSING METAL-METAL OXIDE SYSTEMS Final Report
P. C. Johnson Oct. 1976 32 p refs
(Contract NAS8-29145)
(NASA-CR-150120) Avail: NTIS HC A03/MF A01 CSCL 11F

Techniques for producing model metal-metal oxide systems

for the purpose of evaluating the results of processing such systems in the low-gravity environment afforded by a drop tower facility are described. Because of the lack of success in producing suitable materials samples and techniques for processing in the 3.5 seconds available, the program was discontinued. Author

DATA SUMMARY: Ten metal oxides, four metal-metal compounds, and indium were tested for density and melting point; variables are density (g/cc), melting point; 2 tables include numeric data.

N77-14253*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF CYCLIC CONDITIONS ON THE DYNAMIC OXIDATION OF GAS TURBINE SUPERALLOYS
James R. Johnston and Richard L. Ashbrook Apr. 1974 24 p refs
(NASA-TN-D-7614; E-7594) Avail: NTIS HC A02/MF A01 CSCL 11F

The effects of operating parameters of a dynamic apparatus used to study oxidation and thermal fatigue of gas turbine materials were studied. IN-100, TD-NiCr, and WI-52 were tested at a maximum temperature of 1,090 deg C. Heating time per cycle was varied from 1/20 hr to 10 hr. Minimum temperatures between heating cycles were room temperature, 430 deg, and 650 deg C. Cooling air velocities were zero, Mach 0.7, and Mach 1. Increasing the number of cycles for a given time at temperature increased weight loss. Thermal fatigue was related to number of cycles more than to time at temperature. Author

DATA SUMMARY: 3 alloys were subjected to cyclic heating and cooling; variables are chemical composition, heating time per cycle, cooling air velocity, minimum cooling air temperature, weight change, thermal fatigue cracking; 9 figures and 3 tables include numeric data.

N77-14254# Knolls Atomic Power Lab., Schenectady, N.Y.
ULTRASONIC INSPECTION OF AUSTENITIC CLADDED STEEL
P. Anderson and D. A. Gavin 1976 10 p ref Presented at Eastern Testing Conf., Hartford, 4 May 1976 Sponsored by ERDA
(KAPL-P-4045; Conf-760506-2) Avail: NTIS HC A02/MF A01

A summary of important properties of characteristics associated with the ultrasonic inspection of austenitic cladding materials is presented. These characteristics include attenuation differences, angle beam mis-direction, and zero degree angle beam reflections. The latter characteristic appears as a false 3/8 node shear wave signal, when testing at an angle of 45 degrees. This signal is shown to originate in the unusual grain structure of austenitic cladding. The relative amplitude of the false shear wave indication is shown to vary inversely with the size of the search unit (area) and directly with the test frequency. It is further noted that this effect is sensitive to the direction of clad welding; being significantly greater if the ultrasonic beam is directed perpendicularly to the welding direction. Figures depiciting the above conditions are presented together with suggestions for dealing with these adverse testing properties. ERA

DATA SUMMARY: Analysis of zero degree shear wave signal in ultrasonic tests of austenitic cladded steels; variables are signal amplitude, transducer dimensions, test frequency relative response (clad/unclad), beam reflection angle, attenuation coefficient, clad thickness; 2 figures and 3 tables include numeric data.

N77-14255# Connecticut Univ., Storrs.
CLUSTER CARBURIZING Progress Report, 1 Jun. 1975 - 31 May 1976
John E. Morral Feb. 1976 19 p refs
(Contract AT(11-1)-2354)
(COO-2354-3) Avail: NTIS HC A02/MF A01

The Ta-Hf phase diagram was found to be sensitive to carbon content, even at levels low enough to prevent carbide formation. The beta/alpha solvus at 1,200 C went from 27 to 7 percent Hf as the soluble carbon concentration increased. This effect was seen in aged and carburized samples. Just below the carbide-containing subscale, the dissolved C concentration was greater than in the bulk sample, and correspondingly the amount of alpha phase there was greater. The hardness of the subscales was related to the hardness of the aged, but uncarburized, material. For example, a material aged to 610 KHN produced a subscale of 1,180 KHN, while one aged to 480 KHN produced a subscale of 660 KHN. The subscale had a uniform hardness across its width and grew parabolically with time. The activation energy for growth was 148 kJ/mole, a value near that for C diffusion in Ta. ERA

DATA SUMMARY: Characteristic hardness and thickness are measured; variables are depth, temperature, thickness, time, total peak intensity, volume fraction precipitate, atomic percentage; 8 figures include numeric data.

N77-14256# Los Alamos Scientific Lab., N.Mex.
EXPERIMENTAL EVIDENCE FOR SEVERAL SPHEROID GROWTH MECHANISMS IN THE LIQUID-PHASE SINTERED TUNGSTEN-BASE COMPOSITES
E. G. Zukas, P. S. Z. Rogers (Calif. Univ., Berkeley), and R. S. Rogers (Calif. Univ., Berkeley) Jan. 1976 23 p refs
(Contract W-7405-Eng-36)
(LA-6223-MS) Avail: NTIS HC A02/MF A01

The generally accepted mechanism for spheroid growth during sintering of tungsten-base composites in the presence of a liquid phase is the dissolution of the small spheroids with simultaneous precipitation of tungsten from the molten matrix onto the larger spheroids, the process being driven by the difference in surface energy between the larger and smaller spheroids. Experimental evidence is presented that shows spheroid growth taking place in systems where the tungsten and the matrix are mutually insoluble thereby making dissolution and reprecipitation impossible. Furthermore, the results from these studies and others using the usual matrix compositions indicate that spheroid growth takes place predominantly by the combination or coalescence of two or more spheroids. Deposition of tungsten from the molten matrix also occurs, although not necessarily on spheroid surfaces which have the lowest surface energy. ERA

DATA SUMMARY: Sintering behavior of liquid-phase tungsten-based composites; variables are sintering time, sintering temperature, spheroid diameter, spheroid size distribution, spheroid growth rate; 9 figures include numeric data.

N77-14100# Royal Inst. of Tech., Stockholm (Sweden).
POSSIBLE DENDRITE GROWTH AND SEGREGATION PHENOMENA DURING SOLIDIFICATION OF ALLOYS IN SPACE
H. Fredriksson *In* ESA Mater. Sci. in Space Sep. 1976 p 291-299 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14101# Fulmer Research Inst. Ltd., Stoke Poges (England).
IMMISCIBLE-ALLOY EXPERIMENTS IN SPACE
C. D. Desforges *In* ESA Mater. Sci. in Space Sep. 1976 p 301-308 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14102# Hamburg Univ. (West Germany).
POSSIBILITIES FOR IMPROVING ALLOYS WITH SPECIAL PHYSICAL PROPERTIES IN SPACE
H. Ahlborn *In* ESA Mater. Sci. in Space Sep. 1976 p 309-311 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14103# Commissariat a l'Energie Atomique, Grenoble (France).
REVIEW OF POSSIBLE EUTECTIC-ALLOY SOLIDIFICATION AND THERMODIFFUSION EXPERIMENTS
Y. Malmejac *In* ESA Mater. Sci. in Space Sep. 1976 p 313-317 (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14109# Bologna Univ. (Italy). Ist. di Fisica.
DISPERSION-HARDENED-ALLOY EXPERIMENTS
P. Gondi *In* ESA Mater. Sci. in Space Sep. 1976 p 369-374 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14112# National Bureau of Standards, Washington, D.C.
THE METALLURGY EXPERIMENTS ON THE APOLLO-SOYUZ TEST PROJECT (ASTP)
Elio Passaglia *In* ESA Mater. Sci. in Space Sep. 1976 p 391-400 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N77-14257 British Library Lending Div., Boston Spa (England).
PRESENT STATE OF TESTING THE BURNING AND IGNITION PROPERTIES OF TEXTILES
G. Stamm [1976] 17 p refs Transl. into ENGLISH from Textilveredlung (Basel), v. 10, no. 5, 1975 p 201-206
(BLL-M-24805-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Flammability testing methods used in various countries are surveyed. Emphasis is placed on formulation of international standards of flammability for textiles. J.M.S.

DATA SUMMARY: No numeric data are presented.

N77-14258 British Library Lending Div., Boston Spa (England).
DYNAMIC METHODS FOR MEASUREMENT OF THE INTERNAL FRICTION AND MODULUS OF ELASTICITY OF PLASTICS
A. G. Fedorenko and B. I. Panshin Jun. 1976 32 p refs Transl. into ENGLISH from Metody ispytaniya kontrolya i issledovaniya mashinos troitel'nykh materialov (Moscow), v. 3 p 200-221
(BLL-RTS-9433) Avail: British Library Lending Div., Boston Spa, Engl.: £10.00; 13 BLL overseas or 39 UK BLL photocopy coupons

Measurement of plastic internal friction is a very sensitive method in detecting changes in the structure and properties of matter from irradiation, aggressive liquid, gaseous media, etc. In this way, measurements are made for glass transition temperature, fusion point of crystals, spatial mesh presence in polymers, degree of cross linking, presence of side groups, supermolecular structure in polymers. From the variation of internal friction with frequency or temperature which is caused by thermoelastic or diffusion processes, activation energy is given. Author

DATA SUMMARY: Four test materials and three oscillation types were tested for dynamic modulus of elasticity and internal friction; variables are degree of bar anisotropy, test materials, frequency bands, temperature, oscillation type, stress level, resonance curve, amplitude-independent internal friction, width/thickness ratio, glass textolite grade VFT-S; 7 figures include numeric data.

N77-14259 Princeton Univ., N.J.
BONDING OF SEMICRYSTALLINE THERMOPLASTIC FILAMENTS: POLYPROPYLENE, A CASE STUDY Ph.D. Thesis
Clifford Karl Deakyne 1976 146 p
Avail: Univ. Microfilms Order No. 76-23823

Thermally-induced autohesive bonding in semicrystalline thermoplastic filaments was studied using a laser-bonding technique. Special polypropylene monofilaments of rectangular cross section were bonded in crossed- and parallel-fiber configurations. The effects studied included surface roughness, draw ratio, number-averaged molecular weight, and influence of molecular weight distribution on bond strength. The extent of heating and the rate of cooling, as well as postbonding treatments such as annealing, were also studied. The bonding process was interpreted in terms of fundamental polymer transport and morphological phenomena, involving crystal melting during heating, molecular relaxation and development of molecular contact while melted, followed by interfacial nucleation and subsequent recrystallization during the cooling stage. Crystallization of a molten fiber on an unmelted highly oriented fiber produced bonds superior to those formed when both were melted. Dissert. Abstr.

DATA SUMMARY: Data Summary not prepared due to nonavailability of complete document for processing.

N77-14260 Tennessee Univ., Knoxville.
THE RHEOLOGY OF FIBER FORMATION Ph.D. Thesis
Yoshiaki Ide 1976 233 p
Avail: Univ. Microfilms Order No. 76-24836

Elongational flow behaviors of polymer melts were investigated for various kinds of polymers including low and high density polyethylenes, polystyrenes, polypropylenes, and polymethyl methacrylate. Simple equipment to provide a constant stretch rate condition was developed and used for the study. The elongational viscosity functions for the various polymer melts were obtained. The stress responses were described reasonably well by the Bogue and White model or a generalized convected Maxwell model. A mathematical theory integrating all instability mechanisms - capillarity, ductility, and fracture - was developed and successfully applied to the filament spinnability problem. The extensibility is predicted to show a maximum due to the three competing mechanisms. Dissert. Abstr.

DATA SUMMARY: Data Summary not prepared due to nonavailability of complete document for processing.

N77-14261 Princeton Univ., N.J.
NEW ANALYTICAL TECHNIQUE FOR THE STUDY OF THE THERMAL DEGRADATION OF STYRENES Ph.D. Thesis
Hong Hsiang Kuo 1976 213 p
Avail: Univ. Microfilms Order No. 76-23862

Two relatively new techniques which follow the degradation products of series of polystyrenes as they are heated under controlled conditions, viz., programmable pyrolyzer mass chromatography and programmable pyrolyzer gas chromatography on-the-fly vapor phase infrared computer are described. These systems feature the precise control of temperature and atmosphere to perform pyrolytic analysis, therefore reducing the production of secondary products and providing simple and reproducible chromatogram and infrared spectra. Dissert. Abstr.

DATA SUMMARY: Data summary not prepared due to nonavailability of complete document for processing.

N77-14262*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROCESS FOR PRODUCING FLAME RESISTANT POLYAMIDES AND PRODUCTS PRODUCED THEREBY Patent Application
Madeline S. Toy (Science Applications, Inc., La Jolla, Calif.) and Roger S. Stringham, inventors (to NASA) (Science Applications, Inc., La Jolla, Calif.) Filed 6 Dec. 1976 16 p Sponsored by NASA
(NASA-Case-MSC-16074-1; US-Patent-Appl-SN-747674) Avail: NTIS HC A02/MF A01 CSCL 07C

A photochemical process for producing aromatic polyamides with improved nonflammability characteristics is described. The aromatic polyamide substrate is contacted with a gaseous medium containing a halooefinic material, in a minor amount, and in inert diluent. The aromatic substrate is irradiated with radiation of sufficient energy to effect chemical bonding or grafting of the halooefin to the substrate. The resultant product consists of an aromatic polyamide substrate with halocarbon groups chemically bound to the surface that has enhanced flame resistance in oxygen enriched environment without degradation of physical properties and appearance. NASA

DATA SUMMARY: Results of flammability tests for various modified polyamide substrates; variables include vapor composition in reactor - mole percent N2, C2F3Br, C2F4, flammability characteristics of photografted polyamide substrates; 1 table includes numeric data.

N77-14263# Oak Ridge Y-12 Plant, Tenn. Ceramics and Plastics Development Dept.

BOND STRENGTH OF URETHANE AND EPOXY-MODIFIED ADHESIVES
F. G. Childress, A. K. Zava, and C. E. Miller 26 Mar. 1976 17 p
(Contract W-7405-eng-26)
(Y-2018) Avail: NTIS HC A02/MF A01

A number of urethane and epoxy-modified urethane systems were evaluated as room-temperature-curing adhesives. The systems were formulated to yield a variety of modulus levels and to be compatible with certain chemically sensitive materials. ERA

DATA SUMMARY: Bonding and aging of 13 adhesive systems at 20 C; variables are hardness, visocity, peel strength, tensile strength, cure time, aging time; 11 figures and 6 tables include numeric data.

N77-14264# Rockwell International Corp., El Segundo, Calif.
COMPARATIVE STUDY OF AQUEOUS AND SOLVENT METHODS FOR CLEANING METALS
John L. Briggs and Henry A. Goad 19 Apr. 1976 16 p refs
(Contract E(29-2)-3533)
(RFP-2430) Avail: NTIS HC A02/MF A01

Studies were performed to determine the comparative effectiveness of solvent and aqueous detergent methods for cleaning various metals. The metals investigated included 304L stainless steel, beryllium, uranium-6.5 wt percent niobium alloy, and unalloyed uranium (U-238). The studies were initiated in response to governmental regulations restricting the use of some chlorinated solvents. Results showed that aqueous detergent cleaning was more effective than solvents, i.e. trichloro ethylene and methyl chloroform, for the removal of light industrial soils. The subsequent adoption of aqueous cleaning at this plant has facilitated waste disposal, which contributed to recorded economic savings. The controlled use of aqueous detergents is environmentally acceptable and has decreased the hazards of fire and toxicity that are generally associated with solvents. ERA

DATA SUMMARY: Results of beryllium analytic rinses and water residue tests are presented along with uranium residue tests; variables include sample treatment, cleaning methods, residue (hydrocarbon and inorganic), oxide thickness, time, weight loss, surface condition, corrosion rate, water content; 9 tables include numeric data.

N77-14265# Bishop Coll., Dallas, Tex.
VISCOSITY EFFECTS IN THE RADIATION-INDUCED GRAFTING OF VINYL MONOMERS ON POLYVINYLCHLORIDE FILMS
J. E. Wilson Jan. 1976 32 p refs Submitted for publication
(Contract N00014-72-C-0052; NR Proj. 356-520)
(AD-A026822; TR-7) Avail: NTIS HC A03/MF A01 CSCL 07/3

Radiation-induced grafting rates of styrene on polyvinylchloride (PVC) film were measured in a series of runs at various styrene concentrations, while holding constant the Hildebrand solubility parameter of the grafting solution, and therefore theoretically also holding internal film viscosity constant. The results show rate apparently proportional to the first power of styrene concentration. The rate data are compared and contrasted with those obtained in earlier grafting studies by Takamatsu on styrene/PVC. The rate of acrylonitrile grafting on PVC film was also measured, and overall grafting rates for styrene/PVC and acrylonitrile/PVC are compared on the basis of the calculated values of rates of initiation, rates of propagation, internal monomer concentrations, and rates of termination. Internal film viscosities for several monomer/polymer systems were estimated using an equation derived by Smoluchowski, and the relation between internal film viscosity and the rate of termination by macroradical interaction is discussed. GRA

DATA SUMMARY: Grafting rate dependence on monomer concentration; variables are viscosity, rates (per time), film thickness, plastic properties, grafting; 3 figures and 5 charts include numerical data.

N77-14266# Princeton Univ., N.J.
LOW-FREQUENCY THERMOMECHANICAL SPECTROMETRY OF POLYMERIC MATERIALS: TACTIC POLYMETHYLMETHACRYLATES Technical Report, Jul. 1975 - Jun. 1976
S. J. Stadnicki, J. K. Gillham, and Y. Hazony Jun. 1976 50 p refs Submitted for publication
(Contract N00014-76-C-0200; NR Proj. 356-504)
(AD-A026113; TR-6) Avail: NTIS HC A03/MF A01 CSCL 20/12

A computerized and automated torsional pendulum has been used to characterize amorphous polymethylmethacrylates at about 1 Hz in the temperature sequence 473 to 93 to 473 K. The effects of thermal prehistory, temperature cycling, water content and tacticity are demonstrated. In particular, a comparison of the out-of-phase shear modulus (G:) versus temperature for syndiotactic, atactic and isotactic polymer specimens shows that the intensity of the glassy-state beta loss peak decreases with increasing isotactic content while the temperature of its location remains the same. Extrapolation suggests that completely isotactic polymer would not display a beta loss paak. Author (GRA)

DATA SUMMARY: Three characterized samples of amorphous polymethyl methacrylates with varying tacticity were examined by torsional braid analysis at about 1 Hz in the temperature range 473 to 93 K, using an automated and computerized instrument; variables include shear modulus, temperature, tacticity, molecular weight, relative rigidity, torsional pendulum, and glass transition; 13 figures and 2 table include numeric data.

N77-14113# Leitz (Ernst) G.m.b.H., Wetzlar (West Germany).
INTEREST IN SOLIDIFICATION OF GLASSES AND CERAMICS IN SPACE
K. Deutscher *In* ESA Mater. Sci. in Space Sep. 1976 p 401-404 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N77-14267# European Space Research and Technology Center, Noordwijk (Netherlands).
TESTING ELECTRO EXPLOSIVE DEVICES BY THE BRUCETON METHOD WITH AN APL PROGRAM FOR THE ANALYSIS OF THE RESULTS
J. P. Yribarren and G. Benedetti Paris ESA Mar. 1976 18 p refs
(ESA-TM-161-ESTEC) Avail: NTIS HC A02/MF A01

A guide for the application of the Bruceton test method to the selection of electro-explosive devices is presented. It is a statistical method that, on the basis of the results of firing tests made on a number of electro-explosive devices, enables all fire current and no fire current to be evaluated with a given confidence limit. Author (ESA)

N77-14268# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
PROPELLANT SURVEILLANCE REPORT LGM-30F AND G STAGE 1, PHASE B, SERIES III TP-H1011 Semiannual Report
John A. Thompson Jun. 1976 122 p
(AD-A027299; MANCP-345(76)) Avail: NTIS HC A06/MF A01 CSCL 21/9

This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30 First Stage Minuteman Motors. This report uses a statistical approach to analyze the bulk carton propellant data. Testing was accomplished in accordance with MMEMP Project M72632-5MP116P. The data from this test period are combined with data from previous testing and entered into the GO85 Computer for storage, analysis and regression analysis. From the statistical analysis of all data tested to date (11 years for F and G), significant degradation of the propellant does not appear likely for at least two years past the oldest data point. Each point on the regression plot represents

the mean of all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression plot or group of regression plots. The data range at any age can be found by suitable inquiry of the GO85 system. Author (GRA)

N77-14269# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.

PROPELLANT SURVEILLANCE REPORT LGM-30F, STAGE 2 ANB-3066 Semiannual Report

Elizabeth M. Dalaba Jun. 1976 164 p refs

(AD-A027138; MANCP-342(76)) Avail: NTIS HC A08/MF A01 CSCL 21/9

This report contains test results on Stage II, LGM-30 F and G, ANB-3066 Propellant from lined and unlined cartons. Testing was accomplished in accordance with MMEMP General Test Directive GTD-2 F, G, Amendment 2, and MMEMP Project M72627C. Where sufficient data from unlined cartons were available, regression analysis was used as the method of data evaluation. Lined carton data are presented in Appendix A in tabular form. From the analyses of all unlined regressions, statistically significant trends are not of sufficient magnitude to cause significant degradation within the next 24 months.

Author (GRA)

N77-14270# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.

LGM-30B, STAGE 2 DISSECTED MOTORS TEST REPORT Semiannual Report

Neal M. Hansen May 1976 179 p refs

(AD-A027137; MANCP-338(76)) Avail: NTIS HC A09/MF A01 CSCL 21/9

This report contains test results from physical and chemical properties of propellant and insulation materials from three dissected motors and from their corresponding propellant cartons. Testing was conducted in accordance with Service Engineering General Test Directive GTD-2 Dissect and Project M72633C/5MP-071P. Statistical analysis includes data from both inner (ANP 2864) and outer (ANP 2862) propellant from dissected motors and where available associated propellant cartons. A computer program was utilized to test for common populations between dissected materials, carton materials and individual dissected motors. Linear regression plots, using unique symbols to identify the different relationships between motor and carton data, were used to establish a general trend. Additional data from dissected motor materials will be required before realistic trends can be determined. Most regressions within this report have been taken from the axial orientation position with respect to a segment of the motor and will be so identified.

Author (GRA)

N77-14271# RAND Corp., Santa Monica, Calif.

SOME COST, ENERGY, ENVIRONMENTAL, AND RESOURCE IMPLICATIONS OF SYNTHETIC FUELS PRODUCED FROM COAL FOR MILITARY AIRCRAFT

W. L. Stanley Feb. 1976 24 p refs

(AD-A026667; P-5578) Avail: NTIS HC A02/MF A01 CSCL 21/4

As the availability and economics of jet fuels derived from crude oil become less certain in the future, the United States Air Force will need to consider the implications of utilizing aviation fuels derived from alternative energy resources. This paper examines the most promising energy resource alternative to crude oil and the most attractive aviation fuels derivable from the resource alternatives, with emphasis on coal-based aviation fuels. The findings suggest that coal and oil shale are the most promising energy resource alternatives. A synthetic jet fuel similar to jet fuels in use today appears to be the most attractive aviation fuel derivable from coal, primarily because its production requires lower energy expenditures and results in a less costly fuel product than the other two major alternatives, liquid hydrogen and liquid methane, while offering attractive characteristics for aviation applications. Despite their attractive features, there are definite resource, capacity, and environmental constraints which could tend to limit the availability of synthetic jet fuels in the future. Author (GRA)

N77-14272# RAND Corp., Washington, D.C.

THE POTENTIAL OF LIQUID HYDROGEN AS A MILITARY AIRCRAFT FUEL

William T. Mikolowsky and Larry W. Noggle Feb. 1976 15 p refs

(AD-A026666; P-5577) Avail: NTIS HC A02/MF A01 CSCL 21/4

Liquid hydrogen does not appear to be attractive as a military aircraft fuel for the immediate future. In a wide variety of mission applications, liquid hydrogen is less cost-effective and less energy-effective than the available alternative. Indications are that synthetic jet-fuel is the most attractive alternative fuel for very large airplanes. At the least, this conclusion appears valid until coal reserves are substantially depleted. (Even for relatively high growth rates in coal consumption, domestic coal production is not likely to peak much before the second quarter of the 21st century). This conclusion is substantially strengthened when one realizes that airplanes using a conventional jet-fuel have the potential for a much greater payoff from advances in fuel-conserving aircraft technology. Furthermore, these conclusions prevailed despite our favorable assumptions toward liquid hydrogen in several important instances (e.g., aerial refueling). In summary, there is little, if any, potential for liquid hydrogen as a fuel for aircraft entering the Air Force inventory between now and the end of the century. GRA

N77-14273# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

PHYSICAL AND CHEMICAL PROPERTIES OF JP-4 FUEL FOR 1975 Final Report, Jan. - Dec. 1975

Leonard C. Angello and Phyllis C. Baker May 1976 130 p refs

(AF Proj. 3048)

(AD-A026135; AFAPL-TR-76-19) Avail: NTIS HC A07/MF A01 CSCL 21/4

Test reports on a random sample of 778 batches of JP-4 fuel purchased in calendar year 1975 have been analyzed to determine average properties and frequency distribution for eight geographical districts. Twenty-three of the inspection tests required by the JP-4 fuel specification (MIL-T-5624J) were selected for analyses. Results of the analysis indicated a slight change in the average fuel quality from that reported in 1970 and 1972. This change is reflected in slightly higher average distillation temperatures and lower API gravity values. With exception of Reid Vapor Pressure, no significant difficulties were observed in meeting specification requirements. Comparison of thermal stability test results for ASTM Method D1660 and D3241 showed no significant differences. GRA

N77-14274# Stanford Research Inst., Menlo Park, Calif.

STRUCTURE-PROPERTY CORRELATIONS IN PRIMARY EXPLOSIVES Annual Technical Progress Report, 29 Aug. 1974 - 31 Aug. 1975

John M. Guimont, Marion E. Hill, Robert Shaw, and Craig M. Tarver Sep. 1975 36 p refs

(Contract N00024-75-C-5008)

(AD-A027090; SU-SRI-TPR-75-2) Avail: NTIS HC A03/MF A01 CSCL 19/1

In the first step, the authors measured the time for deflagration to detonation (DDT) as a function of chemical structure for cast primary explosives. The compound methyl-nitrotetro zole was synthesized and confirmed the presence of the nitro group in the compound by infrared analysis. By additivity methods, the heats of formation and the crystal density were estimated. The apparatus for measuring time to DDT in primary explosives was assembled and tested with pressed pellets of lead azide. The second step in this project is to develop and test a model for predicting the time to DDT for cast primary explosives. It was anticipated that the model would be based on Macek's work for secondaries. The third step is to reintroduce some of the physical variables such as density. GRA

N77-14275# Stanford Research Inst., Menlo Park, Calif.

DESENSITIZATION OF EXPLOSIVE MATERIALS Progress Report, 15 May - 14 Jun. 1976

Howard M. Peters and John M. Guimont 2 Jul. 1976 7 p refs

(Contract N00014-76-C-0810; SRI Proj. PYU-5374)

(AD-A027444; PR-1) Avail: NTIS HC A02/MF A01 CSCL 19/1

The objective of the work reported here is to determine the generality of the recent discovery that substitution of fluorine for hydrogen in an explosive material leads to desensitization. In earlier work for Lawrence Livermore Laboratory (ERDA) it was discovered that substitution of the -CH2- group in FEFO with a -CF2- group reduces the sensitivity to impact and low velocity detonation (LVD). A comparison of the sensitivity characteristics and physical properties of FEFO and DFF are shown. GRA

N77-14276# Raytheon Co., Huntsville, Ala. Life Cycle Analysis Dept.

STORAGE RELIABILITY OF MISSILE MATERIAL PROGRAM. SOLID PROPELLANT GAS GENERATORS ANALYSIS Final Report, Jun. 1974 - Jun. 1976

Dennis F. Malik May 1976 31 p refs

(Contract DAAH01-74-C-0853)

(AD-A026717; LC-76-OR3) Avail: NTIS HC A03/MF A01 CSCL 19/1

This report documents findings on the reliability of Solid Propellant Gas Generators. From the data analyzed, aging is indicated after long term storage. The aging mechanisms and trends are given together with a reliability prediction model. This information is part of a research program being conducted by the U. S. Army Missile Command, Redstone Arsenal, Alabama. The objective of this program is the development of non-operating (storage) reliability prediction and assurance techniques for missile materiel. Author (GRA)

N77-14277# Naval Weapons Support Center, Crane, Ind.

ALKALI METAL EMITTERS. 2: IDENTIFICATION OF DIATOMIC FEATURES Final Report, 1 Jul. 1973 - 31 May 1976

Henry A. Webster, III 31 May 1976 14 p refs

(AD-A026550; NWSC/CR/RDTR-30) Avail: NTIS HC A02/MF A01 CSCL 19/1

Visible spectra of flares containing magnesium as a fuel and sodium nitrate, potassium nitrate and rubidium nitrate as oxidizers are examined for molecular emission from species such as diatomic alkali metals, alkali metal-magnesium diatomics and quasi-molecules such as Na-N2. Atomic and molecular emissions are identified and assigned to electronic transitions. Emission characteristics of the atomic emitters are the same as those observed in other studies. Emission bands from diatomic sodium, diatomic potassium and diatomic rubidium are identified. Emission from a sodium-magnesium interaction is also observed. Assignments are made for the electronic states and transitions which give rise to these emitters. The nature of these interactions is discussed. Author (GRA)

N77-14278# Hercules, Inc., Cumberland, Md. Allegany Ballistics Lab.

SHOCK GEL PROCESS FOR SMALL ARMS GUN PROPELLANT Final Report, Jun. 1974 - Jun. 1975

E. Hays Ziegler and Norval F. Stanley Jun. 1976 88 p refs

(Contract DAAA25-73-C-0172)

(AD-A026973) Avail: NTIS HC A05/MF A01 CSCL 19/1

A program was conducted to develop the shock gel process for the manufacture of small arms gun propellants. A 3-5 lb/hr facility to demonstrate the continuous manufacture of 13.4% N nitrocellulose, shock gel gun propellant was designed and operated. Overall operation of the demonstration plant was generally satisfactory. Additional studies to simplify and improve the operation of the continuous leaching process were recommended. The manufacture of shock gel gun propellant utilizing syrups with high nitrocellulose concentration (15% NC) was demonstrated. The resulting propellant had high absolute and gravimetric loading densities. This propellant, deterrent coated with 5% DBP, exceeded the velocity of reference ammunition at chamber pressures below 50,000 psi. Author (GRA)

N77-14279# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Weapon Effects Lab.

EXPLOSIVE EVALUATION: GELLED NITROMETHANE AND SLURRY AS MILITARY BULK EXPLOSIVE SYSTEMS Final Report

Howard H. Reed Jun. 1976 64 p refs

(AD-A026955; WES-MP-N-76-9) Avail: NTIS HC A04/MF A01 CSCL 19/1

A bulk explosive was developed for the ESSEX program which was funded by Defense Nuclear Agency and OCH. This system uses nitromethane, a special gelling agent, and a mixing unit to produce gelled nitromethane. This product has many characteristics that are similar to slurry blasting agents. A slurry is a blasting agent which is a mixture of an oxidizer and a fuel or sensitizer in a liquid medium, thickened with a gum and gelled with a crosslinking agent for water resistance. The chemically active ingredients in most slurries are ammonium nitrate, water, and sometimes sodium nitrate or aluminum. Nitromethane is a nitroparaffin made by vapor phase reaction between nitric acid vapor and propane at high temperature and presence. It is concluded that at present, an aluminized slurry system offers the best alternative for an Army bulk explosive system. Research has been extensive in the slurry industry and rapid advances have been made in the technology. High-energy slurry products are available which are excellent cratering explosives. The problems of slurry mentioned in this report have not been considered problems in industrial operations, and thus have not been adequately addressed. Gelled nitromethane could be considered as an alternative to a slurry system if the difficulties peculiar to slurries cannot be overcome. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N77-14280# Naval Ship Research and Development Center, Bethesda, Md.

A SUMMARY REPORT OF MAJOR STUDIES UNDER THE PROGRAM HIGH-SPEED HYDROFOIL STRUTS AND FOILS

Raymond Wermter and Young T. Shen Dec. 1975 40 p refs

(AD-A026453; DTNSRDC-4779) Avail: NTIS HC A03/MF A01 CSCL 13/10

A three-year program was undertaken to determine the feasibility of developing a strut-foil system for high-speed operation that would also perform satisfactorily at takeoff and moderate speeds. Following identification of possible risk areas and design problems, the major objectives and approaches were established. The evaluation included determination of representative hydrodynamic loads and a series of model tests in the areas of hydrodynamic efficiency, cavity stability, side force and ventilation envelop, and strut flutter. GRA

N77-14281# Naval Postgraduate School, Monterey, Calif.

A STUDY OF PRESSURE-VOLUME RATES AND PLENUM MEMBRANE ADDITIONS TO THE CAPTURED AIR BUBBLE SURFACE EFFECT SHIP XR-3 DIGITAL COMPUTER LOADS AND MOTION PROGRAM M.S. Thesis

John Martin Boggio Jun. 1976 113 p refs

(AD-A026397) Avail: NTIS HC A06/MF A01 CSCL 13/10

A study was conducted of modeling changes to the XR-3 Captured Air Bubble Surface Effect Ship digital computer Loads and Motion program. These changes included the addition of pressure rate and volume rate to the existing 6 degrees of freedom equations. Additional equations were developed to simulate the application of a nonpermeable membrane to the plenum of the XR-3 test craft. The objectives of this study were to determine whether the addition of pressure rate and volume rate equations would improve computer execution time and to test some simplified models of the plenum membrane. Computer timing improvements were demonstrated and membrane modeling results are presented. GRA

N77-14282# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

VUILLEUMIER CYCLE CRYOGENIC REFRIGERATION Final Report, Feb. - Aug. 1975

Ronald White Apr. 1976 67 p refs

(AF Proj. 2126)

(AD-A027055; AFFDL-TR-76-17) Avail: NTIS

HC A04/MF A01 CSCL 13/1

This report describes in detail the Vuilleumier (V-M) refrigeration cycle and various ways it has been applied to produce cryogenic temperatures. It starts with the most theoretical model of the Vuilleumier cycle and gradually adds complicating factors such as void volumes and undesirable heat losses until a real refrigerator is described. Included, are the factors and component characteristics that influence the refrigeration capacity, efficiency, and life of Vuilleumier refrigeration systems. The various ways different designers have mechanized this cycle in their quest for long life are discussed. Author (GRA)

N77-14283# Defense Systems Management School, Fort Belvoir, Va.

METRIC CONVERSION IMPACT UPON DEPARTMENT OF DEFENSE MATERIEL ACQUISITION MANAGERS

Robert W. Carmody Nov. 1975 49 p refs

(DSMS Proj. PMC-75-2)

(AD-A026565) Avail: NTIS HC A03/MF A01 CSCL 05/1

This study focuses on information and guidance concerning the impact of the conversion to the metric system in the Department of Defense. It includes a brief review of metric history, and a report on various positions of interest groups, which include industry, small business and labor, to present their thinking or desires concerning the metric conversion. A status is given on metrication activities in industry and the Federal government to bring materiel acquisition managers up-to-date and contribute to their planning for metrication. Implications are developed and conclusions drawn that should be useful in understanding the impact of metrication on DoD, specifically in the areas of cost, technical performance, schedule, and mission. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N77-14284 Polish Academy of Sciences, Warsaw.

AN OPEN-ENDED WAVE GUIDE EXCITED BY ELECTRIC CURRENT [OTWARTY FALOWOD POBUDZANY PRADEM ELEKTRYCZNYM]

Adam Ciarkowski 19 Dec. 1975 26 p refs In POLISH

Avail: Issuing Activity

An expression is constructed for electromagnetic waveguides. The construction consists of two stages: (1) the field in the waveguides is defined, then it is complemented with a reflected field based on a uniform asymptotic theory of diffraction, and (2) by examining multiple diffractions on the partition edges, a precise asymptotic formula of the reflected field is given. I.M.

N77-14285 Polish Academy of Sciences, Warsaw.

EXCITATION OF ELECTROMAGNETIC WAVES IN A CYLINDRICAL STRUCTURE WITH TWO TRANSMISSION LINES [POBUDZANIE FAL ELEKTROMAGNETYCZNYCH W STRUKTURZE CYLINDRYCZNEJ Z DWOMA PRZEWODAMI]

Halina Kudrewicz 19 Dec. 1975 20 p refs In POLISH

Avail: Issuing Activity

In the course of the development of a system of communication in a mine shaft the problem arose of excitation by a dipole antenna of cylindrical structure with poor-conducting walls (with metal pipes placed inside), elevator carrying lines and transmission lines. An article is presented based on works dealing with coaxial and bifilar modes on a transmission line in a circular tunnel. The partial results presented were used in working out a system of communication in a mine shaft. Author

N77-14286 Polish Academy of Sciences, Warsaw.

A METHOD OF ESTIMATING ERROR FOR CERTAIN WAVE GUIDE PROBLEMS [METODA OCENY BLEDU DLA PEWNYCH ZAGADNIEN FALOWODOWYCH]

Marek A. Szalek 19 Dec. 1976 30 p refs In POLISH

Avail: Issuing Activity

A particular integral equation of the first mode which can be obtained for a certain class of rectangular waveguide joints is examined. Based on an example of an equation for a joint with fine screens, a method of constructing a reciprical operator is described. It is shown that a proof of the existence of a solution to a basic equation can be reduced to a proof of the existence of a solution to a small set of heterogeneous linear algebraic equations. A method of estimating error of an approximate solution and estimating error of linear functions from that solution which define the coefficients of reflection is presented. A good estimation of a functional value is obtained using this method. Author

N77-14287 British Broadcasting Corp., Kingswood (England). Research Dept.

HADAMARD TRANSFORMATION: ASSESSMENT OF BIT-RATE REDUCTION METHODS

C. K. P. Clarke Oct. 1976 31 p refs

(BBC-RD-1976/28) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The main characteristics of the transform signals are outlined and the methods of linear and nonlinear coding used to reduce their bit rate are described. It was found that, with linear coding, a slightly higher bit rate is required to describe the transform coefficients than is needed for the original signal. However, using nonlinear coding, the data rate can be reduced to 7 1/2 bits per sample with no visible impairment. For operation at lower bit rates, it is an advantage to sub-sample the signal at color subcarrier rate before transformation, as this allows more efficient encoding of color signals. Then, at 5 1/2 bits per sample, although many pictures are reproduced without impairment, those containing high contrast edges or saturated or saturated colors are noticeably impaired. Author

N77-14288 British Broadcasting Corp., Kingswood (England). Research Dept.

A WIDEBAND BAND 2 AERIAL

R. D. C. Thoday Sep. 1976 17 p refs

(BBC-RD-1976/25) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A four element end-fire array of dipoles were developed with the aid of a computer program to operate as a transmitting or receiving aerial in the frequency range 88 to 100 MHz. Scale model measurements were made to check the calculated performance, and the radiation patterns show good agreement. The theoretical and measured input admittances are also in good agreement except for a slight departure at the higher frequencies, but it is anticipated that closer agreement will be obtained with measurements performed on a full-size aerial. Author

N77-14289 British Broadcasting Corp., Kingswood (England). Research Dept.

A UHF PROGRAMMABLE DIGITAL FIELD STRENGTH MEASURING RECEIVER

M. W. Harman and J. A. Fox Oct. 1976 10 p ref

(BBC-RD-1976/27) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A description is given of a field strength measuring receiver suitable for measuring broadcast television signals between 470 and 854 MHz. It represents a re-design of an earlier model with digital readout. It gives facilities for automatic operation which permits surveys to be carried out more effectively. Author

N77-14290 British Broadcasting Corp., Kingswood (England). Research Dept.

VIDEO DIGITAL FILTER STUDY 2: TEMPORAL FIRST-ORDER RECURSIVE DIGITAL FILTER

N. E. Tanton Oct. 1976 10 p refs

(BBC-RD-1976/26) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A low pass filter that acts in the temporal frequency domain whilst allowing full spatial frequency resolution on stationary scenes is described. The filter was built in a digital first order recursive form. It works with 8 bit monochrome p.c.m. signals at a 13·3 mHz sample rate. Using the filter, noise was signficantly reduced and, for stationary pictures full spatial frequency resolution was retained. Moving objects were, however, smeared and some

forms of adaptive filter employing movement detection are considered desirable. Author

N77-14291 British Library Lending Div., Boston Spa (England).
APPROXIMATING AN OPTIMUM DECISION RULE (ODR) SUITABLE FOR TECHNICAL REALISATION
I. Vrana Aug. 1975 18 p refs Transl. into ENGLISH from Slaboproudy Obzor (Prague), v. 35, no. 12, 1974 p 570-575 (BLL-DRIC-Trans-4279-(3623.66)) Avail: British Library Lending Div., Boston Spa, Engl.

The problem of reducing the operations number of a target detector is discussed. The properties are analyzed of the so-called truncated and shortened optimum decision rule and it is shown that with the aid of the shortened rule a substantial simplification of the target detector may be achieved without substantial quality deterioration in primary radar signal processing quality. The concept of symmetrical rules is introduced and the advantage of using pairs of symmetrical rules is pointed out. Author

N77-14292* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PHASE MODULATING WITH ODD AND EVEN FINITE POWER SERIES OF A MODULATING SIGNAL Patent
Chase P. Hearn, Richard H. Couch, and Lewis R. Wilson, inventors (to NASA) (LTV Aerospace Corp., Hampton, Va.) Issued 7 Dec. 1976 8 p Filed 29 Sep. 1975 Supersedes N76-10356 (14 - 01, p 0048)
(NASA-Case-LAR-11607-1; US-Patent-3,996,532; US-Patent-Appl-SN-617895; US-Patent-Class-332-22; US-Patent-Class-325-145; US-Patent-Class-332-23R) Avail: US Patent Office CSCL 17B

Method and apparatus is presented for producing a phase-modulated waveform having a high degree of linearity between the modulating signal and the phase of the modulated carrier signal. Two signals representing finite odd and even power series transformations of the modulating signal are produced and multiplied with two quadrature components of the input carrier signal, respectively. One of the multiplied signals is subtracted from the other and the resulting signal is hard-limited to produce a phase-modulated output signal. The means for producing the two signals representing the odd and even power series of the modulating signal includes means for varying the coefficients of the two power series. By means of an existing computer program, the coefficients of the two power series are selected such that there is an extremely high degree of linearity between the modulating signal and the phase of the modulated carrier signal. Official Gazette of the U.S. Patent Office

N77-14293* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMARKS BY DR. JAMES C. FLETCHER AT CONFERENCE ON SATELLITE COMMUNICATION AND PUBLIC SERVICE
James C. Fletcher 9 Dec. 1976 16 p Conf. held at Greenbelt, Md., 9 Dec. 1976
(NASA-News-Release-76-202; P76-10198) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 17B

The present status of communications satellites, together with the future goals and technology developments in use of public service, is assessed. Improvements in design during the last decade considerably cut the cost of their development and launching, and the systems carry information to millions of people on earth. The space shuttles will change the rules in design and make it possible for communications satellites to have multiple frequencies operating at high power. I.M.

N77-14294*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
DESIGN STUDY LANDSAT FOLLOW-ON MISSION UNIQUE COMMUNICATIONS SYSTEM
Aug. 1976 210 p refs
(Contract NAS5-21188)
(NASA-CR-144834; TRW-14897-6007-RU-00) Avail: NTIS HC A10/MF A01 CSCL 17B

Spacecraft subsystem design, performance evaluation, and system tradeoffs are presented for the LANDSAT follow-on mission (LF/O) spacecraft to TDRSS link for the transmission of thematic mapper (TM) and multispectral scanner (MSS) data and for the LF/O spacecraft to STDN and other direct users link for the transmission of TM data. Included are requirements definition, link analysis, subsystem and hardware tradeoffs, conceptual selection, hardware definition, and identification of required new technology. Cost estimates of the recommended communication system including both recurring and non recurring costs are discussed. Author

N77-14295*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
PREENTRY COMMUNICATIONS STUDY. OUTER PLANETS ATMOSPHERIC ENTRY PROBE
C. A. Hinrichs NASA May 1976 97 p refs
(Contract NAS2-9027)
(NASA-CR-137876) Avail: NTIS HC A05/MF A01 CSCL 17B

A pre-entry communications study is presented for a relay link between a Jupiter entry probe and a spacecraft in hyperbolic orbit. Two generic communications links of interest are described: a pre-entry link to a spun spacecraft antenna, and a pre-entry link to a despun spacecraft antenna. The propagation environment of Jupiter is defined. Although this is one of the least well known features of Jupiter, enough information exists to reasonably establish bounds on the performance of a communications link. Within these bounds, optimal carrier frequencies are defined. The next step is to identify optimal relative geometries between the probe and the spacecraft. Optimal trajectories are established for both spun and despun spacecraft antennas. Given the optimal carrier frequencies, and the optimal trajectories, the data carrying capacities of the pre-entry links are defined. The impact of incorporating pre-entry communications into a basic post entry probe is then assessed. This assessment covers the disciplines of thermal control, power source, mass properties and design layout. A conceptual design is developed of an electronically despun antenna for use on a Pioneer class of spacecraft. Author

N77-14296*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
PREENTRY COMMUNICATION DESIGN ELEMENTS FOR OUTER PLANETS ATMOSPHERIC ENTRY PROBE
Jul. 1976 125 p refs
(Contract NAS2-9008)
(NASA-CR-137880; D5070; SCG-60336R) Avail: NTIS HC A06/MF A01 CSCL 17B

Four related tasks are discussed for data transmission from a probe prior to entering the atmosphere of Jupiter to an orbiting spacecraft in a trajectory past the planet: (1) link analysis and design; (2) system conceptual design; (3) Doppler measurement analysis; and (4) an electronically despun antenna. For tasks 1, 3, and 4, an analytical approach was developed and combined with computational capability available to produce quantitative results corresponding to requirements and constraints given by NASA, ARC. One constraint having a major impact on the numerical results of the link analysis was the assumption of a nonsteerable antenna on a spinning orbiter. Other constraints included the interplanetary trajectory and the approach trajectory. Because the Jupiter Orbiter Probe (JOP) program is currently in a state of evolution, all requirements and constraints applied during this study are subject to change. However, the relationships of parameters as developed will remain valid and will aid in planning Jupiter missions. Author

N77-14297*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LASER DOPPLER SYSTEMS IN ATMOSPHERIC TURBULENCE
S. S. R. Murty Washington Nov. 1976 51 p refs
(NASA-TM-X-73354) Avail: NTIS HC A04/MF A01 CSCL 20N

The loss of heterodyne signal power for the Marshall Space Flight Center laser Doppler system due to the random changes in the atmospheric index of refraction is investigated. The current status in the physics of low energy laser propagation through turbulent atmosphere is presented. The analysis and approximate evaluation of the loss of the heterodyne signal power due to the atmospheric absorption, scattering, and turbulence are estimated for the conditions of the January 1973 flight tests. Theoretical and experimental signal to noise values are compared.

Maximum and minimum values of the atmospheric attenuation over a two way path of 20 km range are calculated as a function of altitude using models of atmosphere, aerosol concentration, and turbulence. Author

N77-14298# Lockheed Missiles and Space Co., Palo Alto, Calif.
SUPERHETERODYNE MICROWAVE RECEIVER OF MODULATED OPTICAL RADIATION
V. A. Dianova, V. N. Parygin, and A. Savenok 1976 4 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 3, Fiz. Astron. (Moscow), no. 2, 1976 p 229-232
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The dependence of the difference-frequency component and of the constant current component on the heterodyne signal voltage was studied experimentally in the frequency bands 1-30 mHz and 0.3-5 mHz. A He - Ne laser was used as a monochromatic light source. The heterodyne voltage was delivered to a special system of external electrodes. It is concluded that highly sensitive receivers of microwave modulated optical radiation, operating on the superheterodyne principle, can be created by using standard photomultipliers. The sensitivity of such a system was studied. I.M.

N77-14299# Naval Postgraduate School, Monterey, Calif.
DETECTION OF SIGNALS IN NOISE USING SINGLE CHANNEL RECEIVERS M.S. Thesis. Report, 1 Jan. - 1 Dec. 1975
John Lowell Bilodeau Dec. 1975 44 p refs
(AD-A024931; NPS-30MV3081) Avail: NTIS HC A03/MF A01 CSCL 17/3

A single-channel receiving system capable of detecting low power signals and of determining their angle of arrival is presented. The technique is based on the correlation of a signal with its reflection. The effect of noise is considered, and the feasibility of detecting a signal for which the autocorrelation is known is given. The description of a practical system which was constructed is provided, and the results of operation of this receiving system in the UHF band are presented. Author (GRA)

N77-14300# Illinois Univ., Urbana-Champaign. Electromagnetics Lab.
A METHOD FOR COMBINING INTEGRAL EQUATION AND ASYMPTOTIC TECHNIQUES FOR SOLVING ELECTROMAGNETIC SCATTERING PROBLEMS
Wai Lee Ko and Raj Mittra May 1976 216 p refs
(Contract N00014-75-C-0293; Grant DAHC04-74-G-0113)
(AD-A025461/5; UIEL-76-6; UILU-ENG-76-2549) Avail: NTIS HC A10/MF A01 CSCL 20/14

A new approach is presented for combining the integral equation and high frequency asymptotic techniques, e.g., the geometrical theory of diffraction. The method takes advantage of the fact that the Fourier transform of the unknown surface current distribution is proportional to the scattered far field. A number of asymptotic methods are currently available that provide good approximation to this far field in a convenient analytic form which is useful for deriving an initial estimate of the Fourier transform of the current distribution. An iterative scheme is developed for systematically improving the initial form of the high frequency asymptotic solution by manipulating the integral equation in the Fourier transform domain. A synthetic-aperture-distribution scheme is also developed in which the approximate scattered far-field pattern obtained by asymptotic techniques is improved by systematically correcting the scattered field distribution on an aperture erected in juxtaposition with the obstacle. GRA

N77-14301# Army Night Vision Lab., Fort Belvoir, Va.
HIGH PERFORMANCE PYROELECTRIC VIDICON
F. C. Petito and J. Thomas Cox 1976 15 p refs
(AD-A026144) Avail: NTIS HC A02/MF A01 CSCL 09/1

The pyroelectric vidicon is an infrared imaging closed circuit television system. The sensor used in the camera tube is a thin pyroelectric crystal which requires no cooling for optimum operation. It is a thermal sensor, as opposed to a photon detector, and can therefore be used over a very broad wavelength region. The system is a passive thermal imager which means that it requires, for its operation, only the electromagnetic radiation which is emitted by all objects which are above absolute zero temperature. In addition, the system incorporates optimized 'off the shelf' video electronic circuitry already developed by the television industry and thus the total system cost can be kept low. GRA

N77-14302# Naval Electronics Lab. Center, San Diego, Calif.
OBJECTIVE PERFORMANCE EVALUATION OF COPY GENERATED BY THE TACTICAL DIGITAL FACSIMILE (TDF) VALIDATION MODEL AN/UXC-4(V). PART 2: RANDOM BIT ERROR RATE (BER) MATERIAL Technical Report, 19 Mar. - 1 May 1976
John C. Webster and Fred G. Henry 1 Jun. 1976 18 p refs (NELC Proj. N455)
(AD-A026869; NELC-TR-1981-Pt-2) Avail: NTIS HC A02/MF A01 CSCL 14/3

An evaluation was made to determine the usability of copy generated by the Tactical Digital Facsimile (TDF) validation model and subjected to bit error rates (BERs) obtained from noisy transmission channels. It was found that the users (36 subjects) prefer fewer shades of gray than when the same copy was transmitted without errors. Full-scale evaluation should await the production of copy from the electrophotographic (EP) recorder (back up printer). Author (GRA)

N77-14303# Hughes Aircraft Co., Culver City, Calif. Electro Optical Div.
ADAPTIVE PROGRAMMABLE SIGNAL PROCESSOR STUDY, VOLUME 3 Final Report, 20 Jun. 1975 - 30 Apr. 1976
K. E. Myers Apr. 1976 478 p refs
(Contract F04701-75-C-0241; ARPA Order 2954)
(AD-A026111; HAC-Ref-D4535-Vol-3; HAC-P76-121-Vol-3; SAMSO-TR-83-Vol-3) Avail: NTIS HC A21/MF A01 CSCL 15/3

This report presents the results of a study to define an Adaptive Programmable Signal Processor (APSP) suitable for on-board satellite processing of data generated by spaceborne electro-optical surveillance sensors and dual mode radars. The tasks performed included: (1) definition of system requirements based upon mission requirements supplied by SAMSO, (2) definition of processor performance requirements, (3) configuration of a processor architecture to meet those requirements, (4) evaluation of present and projected semi-conductor device technology applicable to APSP development, (5) identification and preliminary design of those devices critical to APSP development, and (6) preparation of a plan for designing, fabricating and testing a feasibility demonstration model of an APSP, including requirement component development.
Author (GRA)

N77-14304# Air Force Geophysics Lab., Hanscom AFB, Mass.
IONOSPHERIC SCINTILLATION EFFECTS ON VHF-UHF COMMUNICATION SYSTEMS Air Force Surveys in Geophysics
Herbert E. Whitney 3 May 1976 24 p refs
(AF Proj. 4643)
(AD-A026509; AFGL-TR-76-0097; AFGL-AFSG-342) Avail: NTIS HC A02/MF A01 CSCL 20/14

Periods of intense ionospheric scintillations were analyzed in order to provide information for the design and evaluation of the performance of satellite communication links. Scintillation data were available for the auroral and equatorial regions. The amplitude fluctuations are described by cumulative amplitude distributions and show good agreement with the Nakagami m-distribution. A Rayleigh distribution appears to describe the worst case scintillations in the 225 to 400 MHz band. The rate of scintillation is described by level crossing techniques, power spectra, and correlation functions. The effectiveness of diversity techniques is indicated. The spectral index was measured as approximately f to the minus 0.2 power, indicating that intense scintillations can become almost frequency independent in this range. Author (GRA)

N77-14305# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
METHOD OF MOMENTS APPLICATIONS: COUPLING THROUGH A RECTANGULAR APERTURE IN A PLANE

SCREEN Phase Report, Jan. - Dec. 1973
A. T. Adams and D. E. Warren May 1976 88 p refs
(Contract F30602-72-C-0360; AF Proj. 4540)
(AD-A026466; RADC-TR-73-217-Vol-8) Avail: NTIS HC A05/MF A01 CSCL 20/14

This method of moments is used in conjunction with Babinet's principle to treat problems involving coupling of energy through rectangular apertures in a plane screen. The complementary disk is approximated by a wire grid structure, and the method of moments for this wire is then applied. Loaded wires beyond the aperture may also be treated approximately. Aperture size up to about one square wavelength is permitted. GRA

N77-14306# Rome Air Development Center, Griffiss AFB, N.Y.
VLF/LF REFLECTIVITY OF THE POLAR IONOSPHERE, 2 MARCH - 3 MAY 1975
John E. Rasmussen, Ralph J. McLain, and John P. Turtle May 1976 32 p refs
(AF Proj. 4603)
(AD-A026465; RADC-TR-76-146) Avail: NTIS HC A03/MF A01 CSCL 20/14

The report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. VLF long path propagation measurements, along with magnetometer and riometer data, are presented as supplemental information. GRA

N77-14307# Intelcom Rad Tech, San Diego, Calif.
SGEMP PHENOMENOLOGY AND COMPUTER CODE DEVELOPMENT Final Report, Oct. 1973 - Oct. 1974
Thomas N. Delmer, Eugene P. DePlomb, Eric P. Wenaas, and Andrew J. Woods Nov. 1974 113 p refs
(Contract DNA001-74-C-0010; DNA Proj. NWED-QAXE8089)
(AD-A026333; INTEL-RT-8104-029; DNA-3653F) Avail: NTIS HC A06/MF A01 CSCL 20/14

Two new computer codes, DYNA2CYL and DYNASPHERE, have been developed for use in system-generated EMP (SGEMP) and internal EMP (IEMP) problems. The code DYNA2CYL solves Maxwell's equations dynamically and self-consistently in two dimensions (r and z) in the region between two concentric cylinders of finite length. The calculations are for end-on irradiation of the cylinders, which is simulated by specified emission of electrons from either or both the outer and inner cylinders into the cylindrical cavity. The two cylinders can be isolated from one another or connected by an arbitrary load. The outputs of the code are fields and currents on the inner and outer cylinders, the potential difference between the two cylinders, and the current through the load between the cylinders. GRA

N77-14308# Air Weather Service, Scott AFB, Ill.
A BACKGROUND REPORT ON TOTAL ELECTRON CONTENT MEASUREMENTS
Edward D. Beard Dec. 1975 30 p refs
(AD-A026302; AWS-TR-75-260) Avail: NTIS HC A02/MF A01 CSCL 20/14

A simple presentation of ionospheric characteristics, including the D-, E-, and F-regions, is followed by a general description of electromagnetic waves. One of the more important effects of ionospheric interactions with the Very High Frequency (VHF) and Ultra High Frequency (UHF) radio waves, which are used in modern electronic detection and tracking systems, is refraction. Total electron content (TEC) measurements over specific locations are used as data inputs to numerical models of the ionosphere. Some of the basic considerations for measuring TEC of the ionosphere using the Faraday technique and the group-path-delay technique, and a discussion of variation of TEC are included. Author (GRA)

N77-14309# State Univ. of New York, Albany. Dept. of Physics.
SCATTERING OF ELECTROMAGNETIC RADIATION BY APERTURES. 13: THE ELECTRIC FIELD IN THE SLOT NEAR THE TM01 CUTOFF FOR A LONGITUDINALLY NARROW SLOTTED CONDUCTING CYLINDER
L. F. Libelo, R. S. Dunbar, and J. N. Bombardt Apr. 1976 104 p refs
(Contract N60921-75-C-0131; MAT Proj. 03L-000; HDL Proj. E052E6; ZR0110101)
(AD-A026084; NSWC/WOL/TR-76-39) Avail: NTIS HC A05/MF A01 CSCL 20/14

The fields for an infinite slotted circular cylinder are derived for arbitrary incidence and polarization. For a narrow slot and E-polarized incident radiation a large field amplitude is shown to occur in the slot at non-resonant frequencies. For the lowest modes the resonance line in the slot is calculated for a very narrow aperture at normal, symmetric incidence. Measurements in the slot of a finite cylinder are shown along with the effects of varying slot angle, slot length and cylinder length. Author (GRA)

N77-14310# Army Satellite Communications Agency, Fort Monmouth, N.J.
IONOSPHERIC SCINTILLATIONS AT SHF
Luke K. McSherry 1976 13 p
(AD-A026066) Avail: NTIS HC A02/MF A01 CSCL 20/14

Test were conducted on DSCS Phase II Satellite No. 9433 during quiet solar periods and during solar disturbances. In considering the transmission of signals between two or more communication terminals via satellite, ionospheric scintillations present a problem in pulsed systems where information is contained in a coded pulse train and the presence, or absence of a pulse, in a particular train may change the entire context of the message. Such a problem exists in a satellite communication system using digital schemes as a modulation method. No attempt is made here to evaluate the data for a particular application but rather to present information for use as may be required for the system involved. The lack of scintillation data at SHF led to this investigation. GRA

N77-14311# Ohio State Univ., Columbus. ElectroScience Lab.
RCS (RADAR CROSS-SECTION) OF A FINITE LENGTH, PERFECTLY-CONDUCTING CYLINDER ON A PLANAR, UNIFORM IMPEDANCE SURFACE
P. H. Pathak Dec. 1975 77 p refs
(Contract N00140-75-C-6116)
(AD-A026479; ESL-4111-2) Avail: NTIS HC A05/MF A01 CSCL 17/9

The radar cross-section (RCS) of a finite length, perfectly-conducting circular cylinder on a uniform impedance surface is calculated via the geometrical theory of diffraction (GTD). The cylinder is oriented such that its axis is normal to the surface impedance plane. It is found that the effect of the surface impedance is, in general, to enhance the RCS over that without the surface impedance. Both these calculations are presented for comparison. The RCS is, of course, dependent on the angle of incidence, polarization and the frequency of the incident wave; these effects are also investigated. GRA

N77-14312# Naval Postgraduate School, Monterey, Calif.
EVALUATION OF THE AS-3018/WSC-1(V) SHIPBOARD SATCOM ANTENNA
Richard W. Adler, John E. Ohlson, and Bernard K. Hollar Mar. 1976 61 p refs
(AD-A025722; NPS-52AB76031) Avail: NTIS HC A04/MF A01 CSCL 09/5

The AS-3018/WSC-1(V) Satellite Communications Antenna is part of the antenna group OE-82B/WSC-1(V). This report describes measurements of gain and radiation patterns both in and out of the nominal operating frequency band. These results demonstrate that it meets manufacturer's specifications and provide information on the antenna's contribution to the shipboard SATCOM system's susceptibility to RFI. Author (GRA)

N77-14313# Ohio State Univ., Columbus. ElectroScience Lab.
A MOMENT METHOD TECHNIQUE FOR PROBE-FED CAVITY-BACKED SLOT ANTENNAS M.S. Thesis
A. J. Fenn and G. A. Thiele Mar. 1976 106 p refs
(Contract N00014-75-C-0313)
(AD-A025718; ESL-4091-3) Avail: NTIS HC A06/MF A01 CSCL 09/5

A technique is presented which permits the application of the method of moments to cavity-backed slot antennas. Of

specific interest are slot antennas operating over large bandwidths (e.g., 3.3:1) whose aperture distribution cannot be assumed and must be determined by the type of excitation employed, the electrical size of the aperture, and to a lesser extent by mutual coupling effects. Author (GRA)

N77-14314# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

TROPOSPHERIC EFFECTS ON SIGNALS AT LOW ELEVATION ANGLES

Helen S. Hopfield Mar. 1976 42 p refs
(Contract N00017-72-C-4401)
(AD-A025714; APL/JHU/TG-1291) Avail: NTIS HC A03/MF A01 CSCL 17/2

Two possible sources of error in computing a tropospheric range correction from a model are mismatch between the model and the actual refractivity profile, and neglect of a signal path bending. To study the error sources, the tropospheric range effect on a radio signal has been evaluated at different elevation angles, for some observed atmospheres, by three methods: (a) using meteorological balloon data, the effect is evaluated along the computed, curved signal path (this is our best estimate of the true effect and is the standard for comparison); (b) using meteorological balloon data, the effect is evaluated for assumed straight-line propagation; and (c) using only surface meteorological data, the effect is evaluated from the two-quartic tropospheric model for assumed straight-line propagation. The differences ((b) - (a)) and ((c) - (b)), respectively, represent the path-bending component and the profile-mismatch component of the total model error ((c) - (a)). Results are presented in figures. The effect of the model-based correction on the computation of tracking-station position is shown for a few sample cases. Author (GRA)

N77-14315# Army Night Vision Lab., Fort Belvoir, Va.

PHOTOELECTRON NOISE LIMITATIONS IN PERFORMANCE IMAGING SENSORS

Ronald D. Graft 1976 14 p refs
(AD-A026005) Avail: NTIS HC A02/MF A01 CSCL 09/3

In the conventional signal-to-noise ratio analysis of image forming sensors, the imaged area is broken into fictional 'resolution elements' and the noise calculated as the square root of the total number of counts or events, n, falling within a single element. Since the signal is proportional to the total number of counts within the element, the signal-to-noise ratio is square root of n. By postulating a minimum required, or threshold, signal-to-noise ratio, these calculations have led to expressions for the limiting resolution of the device as a function of incident light level. The effects of a finite aperture have been considered by Schade and more recently by Rosell. Schade's analysis led him to define the noise equivalent sampling area as the reciprocal of the noise equivalent passband. The concept of a noise equivalent sampling area has been used by Rosell to calculate the display signal-to-noise ratio and limiting resolution of a variety of television camera tubes. Analyses of this type have been extensively used to calculate the performance of military television systems. In the following analysis some of the ambiguities of the Rosell-Schade approach are resolved. The apriori assumption of the existence of ficticious resolution elements is eliminated and reintroduced only after considerable development. Two equivalent square sampling apertures or areas are defined. GRA

N77-14316# Colorado Univ., Boulder. Electromagnetics Lab.

ELECTROMAGNETIC PENETRATION IN CYLINDRICAL ENCLOSURES Final Report

Carl T. Johnk, David C. Chang, Steve Sandness, and L. Rispin Jan. 1976 155 p refs
(Contract N00173-74-C-0556)
(AD-A026647; SR-17) Avail: NTIS HC A08/MF A01 CSCL 09/3

The report investigates two of the more important coupling schemes in the study of electromagnetic penetration into cylindrical enclosures of lengths comparable to the free-space wavelength of an impinging electromagnetic wave. One of these concerns the penetration through a circular or elliptical hole on the cylindrical surface, and the other deals with the penetration through leakage between a recessed end-cap and the inner surface of the cylinder. GRA

N77-14317# Science Applications, Inc., Berkeley, Calif.

A SURVEY OF RECENT LITERATURE RELATED TO INTERNAL ELECTROMAGNETIC PULSE INTERACTIONS Final Report

M. A. Morgan, B. Fishbine, and F. M. Tesche Kirtland AFB, N. Mex. AFWL May 1976 119 p
(Contract F29601-75-C-0112; AF Proj. 1209)
(AD-A027048; AFWL-TR-75-283) Avail: NTIS HC A06/MF A01 CSCL 09/3

A survey of recent literature relating to electromagnetic pulse internal interaction is presented in this document. For each article reviewed, information is given regarding the description of the problem treated (abstract), model limitations, important conclusions, principal reference, and funding agency. Author (GRA)

N77-14318# Texas Instruments, Inc., Dallas. Equipment Group.

THE MAXIMUM ENTROPY SPECTRUM AND THE BURG TECHNIQUE. TECHNICAL REPORT NO. 1: ADVANCED SIGNAL PROCESSING

Thomas E. Barnard 25 Jun. 1975 84 p refs
(Contract N00014-75-C-0101)
(AD-A026626; TI-ALEX(03)-TR-75-01) Avail: NTIS HC A03/MF A01 CSCL 09/4

This tutorial paper describes the maximum entropy spectrum and the Burg technique for computing the prediction error power and prediction error filter coefficients in the associated spectral estimation formula. The maximum entropy spectrum is identical to the autoregressive spectral estimator. Also included in this paper is a discussion of the K-line spectrum, which is the wavenumber analogue of the frequency-domain maximum entropy spectrum, and the Burg technique modifications necessary for its implementation. The purpose of this paper is to provide a complete and self-contained account of the main features of the maximum entropy spectrum. Since many of the relevant mathematical derivations are not found in the formal published literature, they are incorporated in this paper. Supporting material and various sidelights of the maximum entropy spectrum appear in the appendices. GRA

N77-14319# Naval Electronics Lab. Center, San Diego, Calif.

FW-CW RANGING MULTIPATH INVESTIGATION FOR NAVY VTOL AIRCRAFT Research Report, May 1975 - Apr. 1976

F. E. Morris, S. K. Miyashiro, and B. H. Humpherys 1 May 1976 45 p refs
(AD-A027190; NELC-TR-1986) Avail: NTIS HC A03/MF A01 CSCL 01/5

Evaluation of the range error caused by multipath in a FM-CW range measuring system has been accomplished analytically and experimentally. Tests show that the modulation index-frequency product will have to be significantly increased and the multipath signal levels suppressed by narrow-beam tracking antennas or by use of circularly polarized antennas to achieve 1-foot ranging accuracy in a severe multipath environment. Circular polarization provides a significant improvement against single reflection multipath signals from metal surfaces. Multipath tests show that the FM-CW equipment range accuracy is severely degraded in a strong multipath signal environment but that increasing the modulation index can provide an improvement. Author (GRA)

N77-14320# Riverside Research Inst., New York.

PRESENT STATUS OF THE RRI SLANT-PATH ABSORPTION MODEL (SLAM) COMPUTER PROGRAM Technical Report, 19 Mar. 1975 - 23 Jan. 1976

D. Koppel 23 Jan. 1976 57 p refs
(Contract DAAH01-74-C-0419; ARPA Order 2281)
(AD-A027215; RRI-T-2/306-3-14) Avail: NTIS HC A04/MF A01 CSCL 20/14

A computer program (SLAM) is described which calculates the attenuation by air of microwave and submillimeter radiaton. Besides the horizontal attenuation, the vertical attenuation from various levels down to the ground and out into space is calculated for a fixed frequency. The line profile and atmospheric model can be selected from among several. Comparison is made with other calculations, and with experiments. Possibilities for improving the program are discussed. Author (GRA)

N77-14321# Science Applications, Inc., Albuquerque, N. Mex.
A THREE-DIMENSIONAL SYSTEM GENERATED ELECTROMAGNETIC PULSE CALCULATION OF AN IDEALIZED FLTSATCOM SATELLITE Final Report
B. Goplen, O. Lopez, R. E. Clark, J. E. Morel, and W. A. Seidler Kirtland AFB, N. Mex. AFWL Jun. 1976 32 p refs
(Contract F29601-74-C-0124)
(AD-A026898; SAI-75-512-AO; AFWL-TR-75-261) Avail: NTIS HC A03/MF A01 CSCL 20/14

A three-dimensional system generated electromagnetic pulses (SGEMP) code, MAD3, has been written to calculate replacement currents on structures subjected to X-radiation. Initial results are presented for calculated boom currents on an idealized FLTSATCOM satellite. These results were obtained using a fully dynamic and self-consistent solution of Maxwell's equations at a low fluence level. Modifications are presently being made to the MAD3 code to permit treatment of cases involving space-charge limiting. GRA

N77-14322# Defense Civil Preparedness Agency, Washington, D.C.
DETERMINATION OF EFFECTIVE IONOSPHERIC ELECTRON DENSITY PROFILES FOR VLF/LF PROPAGATION AT MIDLATITUDES
1 Jan. 1976 112 p refs
(AD-A026827; DCA-C600-TP-76-4) Avail: NTIS HC A06/MF A01 CSCL 20/14

The report presents experimental data derived from field strengths of VLF/LF signals between 9 and 56 kHz measured on several mid-latitude paths. Comparisons between experimental data and theoretical predications are shown for several flights, both in daytime and in nighttime, over the path from Hawaii to southern California. The comparisons show that an essentially constant exponential electron density profile describes the data for all the frequencies in the above range for daytime; whereas at night, the best fit exponential profile gradient increases with frequency. GRA

N77-14323# Harry Diamond Labs., Adelphi, Md.
REFLECTED AND TRANSMITTED FIELDS FOR A PLANE-WAVE PULSE INCIDENT ON A CONDUCTING GROUND
Egon Marx Apr. 1976 60 p refs
(DA Proj. 1W1-62118-AH-75)
(AD-A026755; HDL-TR-1740) Avail: NTIS HC A04/MF A01 CSCL 20/14

Computer code GROUND is presented for determination and plotting of the total electric and magnetic fields in air and those transmitted below the surface for a plane-wave pulse incident on a ground of finite conductivity. The theory required to write down the necessary equations is also presented. The input to the code can be analytic, such as a double exponential, or a digitized trace. A number of parameters determines the characteristics of the medium and the wave, and the flow of the program. GRA

N77-14324# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
INVESTIGATION OF AURORALLY DISTURBED IONOSPHERES USING THE PARTIAL-REFLECTION SOUNDER TECHNIQUE Final Report, 1 Jul. 1973 - 30 Jun. 1974
Glenn D. Falcon 14 Nov. 1975 41 p refs
(DNA Proj. NWET-L25AAXHX635)
(AD-A026686; DNA-3943F) Avail: NTIS HC A03/MF A01 CSCL 20/14

The application of the partial reflection technique to portions of the ionosphere involved in mechanisms of radio wave (VLF, LF) propagation is described. Theoretical and experimental considerations are discussed. Author (GRA)

N77-14325# Naval Research Lab., Washington, D.C.
ENHANCEMENT OF ABSORBED DOSE FOLLOWING AN Au-Si INTERFACE FOR INCIDENT LOW-ENERGY X RADIATION
James B. Langworthy and Mervine Rosen Jun. 1976 36 p refs
(NRL Proj. H01-53)
(AD-A027039; NRL-MR-3302) Avail: NTIS HC A03/MF A01 CSCL 09/1

It is shown that the presence of a thin surface of gold (or any high-Z material) enhances the absorbed dose in the active region of a silicon device subjected to low energy X radiation by a large factor. For the cases of 50 keV, and 200 keV monoenergetic X-ray beams incident on silicon covered with 4 micrometers of gold, enhancement factors of 9.2, 17.4, and 6.7 at distances in the silicon of 1 micrometer, 3 mirometers and 8 micrometers respectively were obtained. Continuous blackbody radiation (kT = 10 keV and kT = 15 keV) hardened by the walls and device packaging of a model satellite gave rise to dose enhancement factors of 12.6 and 14.9 respectively in the first 3 micrometers of silicon. Dose enhancement profiles are obtained for all the above cases, and in addition absolute absorbed dose profiles in silicon are obtained for the two hardened continuous spectra. GRA

N77-14326# Naval Research Lab., Washington, D.C.
A REVIEW OF ANOMALOUS RESISTIVITY FOR THE IONOSPHERE
K. Papadopoulos Apr. 1976 75 p refs
(NRL Proj. A03-16; PR0330242)
(AD-A026628; NRL-MR-3275) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report is written for nonspecialists. The primary goal of the report is to provide a review on the nonlinear theory of conventional and unconventional forms of anomalous resistivity from a unified point of view and analyze the strengths and weaknesses of each mechanism as applied to ionospheric phenomena. Topics discussed include the following: Classical resistivity; General formulation of resistivity; Anomalous resistivity due to current driven instabilities; Anomalous resistivity in plasmas stable to current driven instabilities; Production of runaways; Ionospheric and magnetospheric observations and theories related to anomalous resistivity. GRA

N77-14327# Institute for Telecommunication Sciences, Boulder, Colo.
FM BROADCAST COVERAGE OF THE COTERMINOUS UNITED STATES
George A. Hufford Jul. 1976 34 p refs
(PB-257013/3; OTR-76-93) Avail: NTIS HC A03/MF A01 CSCL 17B

The radio system comprised by the FM broadcast stations and of how well it covers the coterminous United States is presented. Using automatic processing techniques to manage the data base, to find the necessary environmental parameters, to compute the service ranges, and to produce the graphics and maps, were prepared which show the geographic distribution of the coverage in some detail. A further calculation reveals that 84% of the land area of the United States is served by at least one FM signal having a median field strength of 50 microvolts/m or more, and 53% is served by at least one having a median field strength of 1 microvolts/m or more. GRA

N77-14328# Mission Research Corp., Santa Barbara, Calif.
NOTE ON THE USE OF CHARGE INJECTION FOR SGEMP SIMULATION
Conrad L. Longmire Jul. 1975 27 p
(Contract DNA001-75-C-0125; DNA Proj. NWED-QAXEB069)
(AD-A027218; MRC-N-175; DNA-3656T) Avail: NTIS CSCL 18/8

This note discusses techniques and rationale for using self-contained electrical pulsers for simulating system-generated electromagnetic pulse (SGEMP) generated by X rays striking satellites. Author (GRA)

N77-14051*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MAGNITUDE OF 64-m ELEVATION AXIS MOVEMENTS DUE TO ALIDADE TEMPERATURE CHANGES
N. T. Hung, H. Phillips, and R. Zanteson *In its* The Deep Space Network 15 Dec. 1976 p 41-44 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 17I

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N77-14329 Polytechnic Inst. of New York.
INSULATION CONTAMINATION ON VERY HIGH VOLTAGE ELECTRICAL TRANSMISSION LINES Ph.D. Thesis
Henry Greber 1976 236 p
Avail: Univ. Microfilms Order No. 76-23406

Methods of approach are developed by use of the introduced geometrical models. Relationships between the conductivity of the pollution layer and insulation flashover are derived. On the basis of mathematical models of difference and differential equations, formulae for the voltage distribution on insulator chains are derived under different assumptions of stray capacitance distributions on these insulators. It is demonstrated that, by application of stability theory concepts to the problem of insulator flashover, valuable insights and quantitative relations can be gained, as well as adaptive control possibilities are revealed. Dissert. Abstr.

N77-14330 British Library Lending Div., Boston Spa (England).
DEVELOPMENT OF EXTRA-HIGH VOLTAGE CROSS-LINKED POLYETHYLENE CABLES PRODUCED BY THE MDCV PROCESS
T. Ichino and K. Sugiyama Nov. 1976 13 p refs Transl. into ENGLISH from Dainichi Nihon Densen Jiho (Japan), v. 59, 1975 p 7-10
(BLL-RTS-10162) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Void-free insulation cables of extra-high voltage application have been developed. The cable structure, mechanical properties, and long term load tests are described. It is concluded that, despite their large size, the cables sustain very stable characteristics over long periods. I.M.

N77-14331 British Library Lending Div., Boston Spa (England).
THE LONG-TERM STABILITY OF HIGH TENSION CROSS-LINKED POLYETHYLENE CABLE MADE BY THE MDCV PROCESS
K. Sugiyama Sep. 1976 19 p refs Transl. into ENGLISH from Dainichi Nihon Densen Jiho (Japan), v. 59, 1975 p 11-16
(BLL-RTS-10163) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas or 30 UK BLL photocopy coupons

The results of long term stability tests on high tension overhead power line insulation cables are presented. No deterioration was detected during the tests of high temperature impulse voltage V-n characteristics, voltage endurance by the Waltz Mill method, V-n characteristics at room temperature and under heat cycle, dc damped oscillation wave endurance characteristics, and water immersion voltage endurance. It is concluded that the cables produced have high reliability and are superior to those produced by steam vulcanization. I.M.

N77-14332 British Library Lending Div., Boston Spa (England).
CONTAMINATION-FREE SYSTEM FOR CROSS-LINKED POLYETHYLENE CABLE INSULATION
H. Takemori Sep. 1976 22 p refs Transl. into ENGLISH from Dainichi Nihon Densen Jiho (Japan), v. 59, 1975 p 17-24
(BLL-RTS-10164) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL overseas or 60 UK BLL photocopy coupons

A contamination-free system which minimizes voids and foreign matter in the final cable product was developed. A consistent exhaustive system from polymerization of polyethylenes to extrusion of foreign matters, such as resins, rusted iron, dust particles and lint was studied and laboratory controls of the processes were implemented. As a result, the quality of the polyethylene raw material has been improved to meet the requirements of high voltage power cable insulation reliability. I.M.

N77-14333* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INRUSH CURRENT LIMITER Patent
Robert A. Kichak, inventor (to NASA) Issued 7 Dec. 1976 5 p Filed 6 Jan. 1975 Supersedes N75-16748 (13 - 08, p 0878)
(NASA-Case-GSC-11789-1; US-Patent-3,996,506; US-Patent-Appl-SN-538982; US-Patent-Class-321-13; US-Patent-Class-317-31) Avail: US Patent Office CSCL 09C

A circuit arrangement for limiting turn-on current inrush and current rate of rise in dc-to-dc power converters is considered. A transistor control circuit is disposed between the input dc power source and the transistor oscillator circuit of the converter to provide a ramp of current thereto. The transistor control circuit functions as a time-variable current limiter initially while in the active region and as a saturated switch in the steady-state region. A feedback arrangement allows the saturation drive current to be provided from the converter at a lower voltage level than that which may be required from the dc power source to reduce dissipation and increase efficiency. Official Gazette of the U.S. Patent Office

N77-14334* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LINEAR PHASE DEMODULATOR INCLUDING A PHASE LOCKED LOOP WITH AUXILIARY FEEDBACK LOOP Patent
Ronnie R. Rippy, inventor (to NASA) Issued 14 Dec. 1976 8 p Filed 26 Nov. 1975 Supersedes N76-13169 (14 - 04, p 0416)
(NASA-Case-GSC-12018-1; US-Patent-3,997,848; US-Patent-Appl-SN-635531; US-Patent-Class-329-122; US-Patent-Class-329-124; US-Patent-Class-331-23; US-Patent-Class-331-36C; US-Patent-Class-332-30V) Avail: US Patent Office CSCL 09C

A phase modulated wave that may have no carrier power is demodulated by a phase locked loop including a phase detector for deriving an A.C. data output signal having a magnitude and a phase indicative of the phase of the modulated wave. A feedback loop responsive to the data output signal restores power to the carrier frequency component to the loop. In one embodiment, the feedback loop includes a phase modulator responsive to the phase modulated wave and the data output signal. In a second embodiment, carrier frequency power is restored by differentiating the data output signal and supplying the differentiated signal to an input of a voltage controlled oscillator included in the phase locked loop. Official Gazette of the U.S. Patent Office

N77-14335* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLID-STATE CURRENT TRANSFORMER Patent
David L. Farnsworth, inventor (to NASA) (Westinghouse Electric Corp., Baltimore) Issued 7 Dec. 1976 4 p Filed 23 Jun. 1975 Supersedes N75-26251 (13 - 17, p 2106) Sponsored by NASA
(NASA-Case-MFS-22560-1; US-Patent-3,996,462; US-Patent-Appl-SN-589233; US-Patent-Class-250-214A; US-Patent-Class-330-14; US-Patent-Class-330-28; US-Patent-Class-330-59) Avail: US Patent Office CSCL 09C

A signal transformation network which is uniquely characterized to exhibit a very low input impedance while maintaining a linear transfer characteristic when driven from a voltage source and when quiescently biased in the low microampere current range is described. In its simplest form, it consists of a tightly coupled two transistor network in which a common emitter input stage is interconnected directly with an emitter follower stage to provide virtually 100 percent negative feedback to the base input of the common emitter stage. Bias to the network is supplied via the common tie point of the common emitter stage collector terminal and the emitter follower base stage terminal by a regulated constant current source, and the output of the circuit is taken from the collector of the emitter follower stage. Official Gazette of the U.S. Patent Office

N77-14336 Illinois Univ., Urbana-Champaign.
THE CURRENT DISTRIBUTION ALONG STATIONARY AND MOVING RESISTIVE WIRE ELECTRODES Ph.D. Thesis
Richard Dicran Varjian 1976 186 p
Avail: Univ. Microfilms Order No. 76-24196

Experiments have been performed to measure the potential distribution along a thin platinum wire situated in the center of a large trough of rectangular cross-section. The electrolyte consisted of iodine, potassium iodide and sulfuric acid in varying concentrations. The potential distribution was measured by crimping leads onto the wire at several points. A previously developed theoretical model of a similar cell predicted the qualitative features of the experimental system at low applied potentials. The theoretical and experimental results deviated at higher applied potentials since the model neglected diffusion polarization which becomes significant at high applied potentials in the experimental system. Substantial agreement was obtained at higher applied potentials when the experimental data was corrected for concentration effects. Dissert. Abstr.

N77-14337 State Univ. of New York, Buffalo.
A NETWORK MODEL AND CONDUCTOR SHAPE CLASSIFICATION SCHEME FOR THE MACRO-ROUTING OF DIGITAL PRINTED CIRCUIT BOARDS Ph.D. Thesis
Arnold Conrad Keller 1976 192 p
Avail: Univ. Microfilms Order No. 76-26534

A theoretical approach to the analysis of rectangular graphs and networks is presented as a basis for the development of a capacitated network representation of the printed circuit board. Portions of the various conductor pathways in the network are partitioned into two mutually exclusive and collectively exhaustive subsets. The macro-routing process classifies conductors in terms of these subsets, and this classification scheme is used to generate an ordered list of conductors and their initial (macro) shapes. Built-in adaptive policies are included which can subsequently modify the conductor shapes so as to minimize the creation of conductor congestion. This enhances the chances of obtaining a feasible layout if one exists. The output of this algorithm is utilized by a pc board designer as a preliminary evaluation aid and a conductor routing schedule and map as he fills in the micro-routing details. Dissert. Abstr.

N77-14338*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SURVEY OF PARTICLE CONTAMINATION IN ELECTRONIC DEVICES
John W. Adolphsen, William A. Kagdis, and Albert R. Timmins Dec. 1976 38 p refs
(NASA-TM-X-71245; X-311-76-266) Avail: NTIS HC A03/MF A01 CSCL 09A

The experiences are given of a number of National Aeronautics and Space Administration (NASA) and Space and Missile System Organization (SAMSO) contractors with particle contamination, and the methods used for its prevention and detection, evaluates the bases for the different schemes, assesses their effectiveness, and identifies the problems associated with each. It recommends specific short-range tests or approaches appropriate to individual part-type categories and recommends that specific tasks be initiated to refine techniques and to resolve technical and application facets of promising solutions. Author

N77-14339*# Kanner (Leo) Associates, Redwood City, Calif.
SUPERCONDUCTIVITY AT HIGH TEMPERATURES
Bernd T. Matthias Washington NASA Dec. 1976 25 p refs Transl. into ENGLISH of La Rech. (France), v. 4, no. 33, Apr. 1973 p 319-326
(Contract NAS2-2790)
(NASA-TT-F-17317) Avail: NTIS HC A02/MF A01 CSCL 09C

Various possible methods of achieving superconductivity at temperatures above 21 K with new materials are discussed. It is suggested that empirical approaches to the problem of finding new superconductors can sometimes be more effective than a rigid adherence to theoretical approaches. Author

N77-14340*# Kanner (Leo) Associates, Redwood City, Calif.
INVESTIGATION OF THE HALL EFFECT. EXPERIMENTAL STUDY OF POWDER SAMPLES OF HIGH ELECTRICAL RESISTIVITY
J. Cherville and P. Bothorel Washington NASA Dec. 1976 57 p refs Transl. into ENGLISH of Ann. Chim. (Paris), v. 8, 1963 p 613-636
(Contract NASw-2790)
(NASA-TT-F-17333) Avail: NTIS HC A04/MF A01 CSCL 09A

An apparatus is described for investigation of the Hall effect of powder samples with electrical resistivities as high as 1,000,000 ohm-m. The samples were charged through a reversing switch allowing continuous change of current direction with 1-msec dc pulses, and the Hall voltage, UH, developed in a magnetic field of 15 kilogauss was recorded. Also described is the measurement of UH with alternating voltage. The application of the methods to pyrolytic carbon, tempered at 600-110 deg, is described. Author

N77-14341*# Kanner (Leo) Associates, Redwood City, Calif.
HALL EFFECT AND RESISTANCE OF A SPHERE
S. Flandrois and P. Maraval Washington NASA Jan. 1977 6 p Transl. into ENGLISH from Effet Hall et resistance de la sphere, Academi des Sciences, Comptes Rendus, series B, (France), v. 267, no. 14, 20 Sep. 1968 p 658-628
(Contract NASw-2790)
(NASA-TT-F-17369) Avail: NTIS HC A02/MF A01 CSCL 09C

A theoretical evaluation was made of the electric resistance and Hall coefficient of a sphere as a function of the diameter of the electric contacts. Author

N77-14342# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE EFFECTIVE ELECTRICAL CONDUCTIVITY OF AN ELECTROLYTE IN POROUS BODIES
V. N. Zhuravleva and A. G. Pshenichnikov 1976 5 p refs Transl. into ENGLISH from Elektrokhimiya (USSR), v. 12, no. 6, 1976 p 851-855
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Electrolyte resistivities were measured in hydrophilic and hydrophobic porous bodies as a function of the fluid content. It was found that for all the structures investigated, the meandering factor is inversely proportional to the square of the fluid porosity. On the basis of these considerations, an attempt is made to give such a dependence and a foundation. I.M.

N77-14343# Oak Ridge National Lab., Tenn.
PROGRAM FOR DEVELOPMENT OF TOROIDAL SUPERCONDUCTING MAGNETS FOR FUSION RESEARCH
H. M. Long and M. S. Lubell Apr. 1976 92 p Supersedes ORNL/TM-5109
(Contract W-7405-eng-26)
(ORNL/TM-5401-Rev; ORNL/TM-5109) Avail: NTIS HC A05/MF A01

Research progress on the following subprograms is described/: (1) system design, (2) coil design, (3) conductor selection and test, (4) radiation effects on superconducting coils, (5) coil protection, eddy current shielding, and power supply, (6) structural analysis and materials investigation, (7) cryogenics and refrigeration, (8) subsize coil fabrication, (9) large coil project, (10) coil testing and evaluation, (11) administrative plan, and (12) quality assurance and reliability. ERA

N77-14344# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
GROUND DETECTOR FOR A FLOATING, HIGH CURRENT DC SYSTEM
W. J. Woodward May 1976 13 p refs
(Contract AT(07-2)-1)
(DP-1413) Avail: NTIS HC A02/MF A01

An instrument is described for detection of electrical grounding of the 3.6 megawatt dc test loop. The dc loop is ungrounded except for leakage through cooling water in the buses and loads. A high-frequency, low-voltage signal is applied to the positive dc bus. A tuned amplifier receives the signal from the negative bus. Loss of the received signal indicates a ground at either bus or at the load. Alarm and shutdown circuits are actuated whenever a ground occurs. Author

N77-14345# IIT Research Inst., Chicago, Ill.
NUCLEAR ELECTROMAGNETIC PULSE (NEMP) HARDENED CABLES Final Report, 1 Jul. 1973 - 31 Oct. 1975
William C. Wells and Yih Shiau Apr. 1976 135 p refs
(Contract DAAB07-73-C-0341; DA Proj. C85-04233-01-C8)
(AD-A026020; ECOM-73-0341-F) Avail: NTIS HC A07/MF A01 CSCL 09/1

Energy from a Nuclear Electromagnetic Pulse (NEMP) couples into a system via the interconnecting cables. Calculations of the current induced on the sheath of a horizontal cable above a ground plane are discussed. These currents on the exterior of the sheath then excite the interior of the cable via the surface transfer impedance (Z sub T). The objective of reducing NEMP coupling into cables is met by reducing the transfer impedance of the cable sheath. A standard test procedure is used to measure (Z sub T). Typical military and commercial braided cable shields are measured first. Then, to more systematically approach the problem of reducing (Z sub T), a set of twelve preliminary prototype cable shields are constructed. The effects of braid angle, braid material, distance separating braid layers and interbraid materials (specifically insulators, aluminized Mylar foils, carbon loaded polyethylene and a ferromagnetic foil) on (Z sub T) are investigated. GRA

N77-14346# Ni-Tec, Inc., Skokie, Ill.
RELIABILITY TEST FOR IMAGE INTENSIFIER ASSEMBLY, 25 MILLIMETER MICROCHANNEL INVERTER Technical Report, 10 Oct. - 12 Dec. 1975
Dec. 1975 38 p refs
(Contract DAAG53-75-C-0300)
(AD-A026692) Avail: NTIS HC A03/MF A01 CSCL 09/1

The reliability testing (MTTF) of ten (10) Image Intensifier Assemblies was initiated, after the successful completion of first Article testing. GRA

N77-14347# Stanford Univ., Calif. Edward L. Ginton Lab.
MICROWAVE ACOUSTIC AND BULK DEVICE TECHNIQUE STUDIES Interim Technical Report, 1 May - 31 Oct. 1975
May 1976 35 p refs
(Contract F30602-74-C-0038; AF Proj. 5573)
(AD-A026748; SU-GL-2554; RADC-TR-76-152; ITR-4) Avail: NTIS HC A03/MF A01 CSCL 09/1

A monolithic silicon convolver has been constructed incorporating a SAW waveguide which provides a 20 dB improvement in efficiency over convolvers without waveguides. The waveguide is formed by an etched pattern in a deposited zinc oxide film which forms the piezoelectric medium in the device. A technical report has been prepared on a new method of designing coupled resonator networks for wide band SAW devices, jointly with another contract. This approach has yielded 20% bandwidths for convolvers using zinc oxide on silicon. The last report described experiments establishing the principle of a new analog/digital converter using a SAW delay line. The first model operation with 4-bit word accuracy. The authors have made a computer analysis of the SAW delay line requirements for increasing to 8-bit conversion capacity, which correlates with results obtained on the earlier system, and are using this to design a new SAW delay line for an 8-bit system. Digital comparator and counting circuitry for the system has been designed, using an approach which should render the accuracy of the complete system independent of temperature variations. GRA

N77-14348# Army Electronics Technology and Devices Lab., Fort Monmouth, N.J.
LOW TEMPERATURE PRESSURE-OXIDATION OF SILICON FOR INTEGRATED CIRCUIT TECHNOLOGY
Robert J. Zeto, Clarence G. Thornton, Eugene Hryckowian, and Charles D. Bosco 1976 13 p refs
(AD-A026169/3) Avail: NTIS HC A02/MF A01 CSCL 09/5

The cost, reliability, and performance of large scale integrated circuit devices are adversely affected by the large number of process-induced chemical and physical defects that result from high processing temperatures in the range 950 to 1,250 C. This impact is particularly severe in the case of oxide-isolated processes and silicon-on-sapphire technology as used to produce specialized military devices for lowpower, high density, and radiation hardened applications. GRA

N77-14349# Harry Diamond Labs., Adelphi, Md.
SIMPLE APPROXIMATE SOLUTIONS TO CONTINUOUS-TIME-RANDOM-WALK TRANSPORT
Flynn B. McLean and George A. Ausman Apr. 1976 21 p refs
(DA Proj. 1T1-61102-AH-44)
(AD-A026527; HDL-TR-1751) Avail: NTIS HC A02/MF A01 CSCL 09/1

This paper presents a procedure for obtaining simple approximate solutions to the continuous-time random walk (CTRW) as it applies to charge transport in amorphous materials. Application of this procedure to a particularly simple trial function leads to an approximate solution that is in excellent agreement with the exact solution for the case in which it is known. The approximate solutions have proved to be very useful in applications of the CTRW theory to observable transport processes such as transient charge relaxation, following exposure to pulsed ionizing radiation, in thin films of amorphous insulators used in metal-insulator-semiconductor capacitors. Author (GRA)

N77-14350# Northeastern Univ., Boston, Mass. Electronics Research Lab.
BIAS AND SIGNAL PROCESSING CIRCUITS FOR A MASS SPECTROMETER IN THE PROJECT EXCEDE: SWIR EXPERIMENT Interim Report
Raimundas Sukys, Steven Goldberg, and J. Spencer Rochefort Oct. 1975 55 p refs
(Contract F19624-74-C-0042; DNA Proj. NWET-L11CAXHX504)
(AD-A026514; Scientific-2; AFGL-TR-76-0060) Avail: NTIS HC A04/MF A01 CSCL 17/8

Bias and signal processing circuits designed for a mass spectrometer in the project EXCEDE: SWIR experiment are described in this report. In this experiment a rocket-based electron gun injects a stream of electrons into the atmosphere. This causes a buildup of a positive charge on the vehicle severely limiting the measurement capability of the positive ion mass spectrometer. To overcome this limitation under a wide range of vehicle potential buildup a varying negative bias voltage is applied to the front plate and the grid-rod structure of the quadrupole mass filter. Circuits generating and controlling the variable bias voltages are described in detail. Logarithmic data signal processing circuits and modifications, dictated by the bias requirements, of some already existing circuits are presented. Author (GRA)

N77-14351# Microwave Associates, Inc., Burlington, Mass.
PRODUCTION ENGINEERING MEASURE FOR LOW NOISE SOLID-STATE OSCILLATOR Final Report
John C. Collinet and Lester C. Nelson Feb. 1976 245 p refs
(Contract DAAB05-72-C-5861)
(AD-A026910; ECOM-5861-F) Avail: NTIS HC A11/MF A01 CSCL 09/5

The initial program objectives were to develop a low noise, Ku-band, GaAs IMPATT diode oscillator which could be used as an LO for a portable radar. Gallium arsenide IMPATT diodes were fabricated which met the basic requirements of the program, but the yields were inadequate for a PEM program. Subsequently, the program was modified to use low noise, GaAs Gunn diodes which were built with high yields for this program. A Ku-band local oscillator was then designed, fabricated, tested, and finally, manufactured during the pilot run phase of the program. The program was eventually modified to include a second local oscillator, for X-band operation. Both types of oscillators were environmentally tested according to the MIL-Specs, and were found to meet all of the final specifications. Pilot production procedures and specifications were generated for both types of units. A quality control procedure was also established for these components. Author (GRA)

N77-14352# Syracuse Univ., N.Y. Dept. of Industrial Engineering and Operations Research.
RECTANGULAR FLAT-PACK LIDS UNDER EXTERNAL PRESSURE Final Technical Report, Jun. 1973 - Sep. 1974
Charles Libove Griffiss AFB, N.Y. RADC May 1976 69 p refs
(Contract F30602-71-C-0312)
(AD-A025625; RADC-TR-76-118; TR-74-2) Avail: NTIS HC A04/MF A01 CSCL 09/5

An analysis is made of the tensile stresses in the lid seal and the lid deflections for a rectangular flat-pack under external pressure. On the basis of this analysis, formulas and charts are presented to facilitate (1) the proper design of the package so that it will retain its hermeticity under a given screening pressure and (2) the selection of the proper pressure to use in the hermeticity screening of an already designed package. Information is also given on the approximate equivalence of external pressure and centrifuge acceleration in regard to the seal stresses and lid deflections of a rectangular flat-pack. Author (GRA)

N77-14353# Harry Diamond Labs., Adelphi, Md.
NEW CONCEPT OF SURVIVABILITY ENHANCEMENT WITH SELF-ORGANIZING ELECTRONIC CIRCUITS
Berthold Zarwyn 1976 15 p refs
(AD-A026168) Avail: NTIS HC A02/MF A01 CSCL 09/3

Despite increasing complexity of electronic circuitry and stringent performance and reliability standards imposed on it, the basic design philosophy has changed little over the years. It is true that design tools, such as computer, have speeded the design process or made it more tractable, but in analyzing or synthesizing a circuit one uses essentially the classic ohmic laws in complex variable plane or their equivalent in the form of a graph theory. Although there are powerful analytical or graphical tools employed in the design process based on the above foundations, such as Laplace transforms, spectral analysis, topological algebra, etc., they all require a detailed knowledge of every element in the circuit and its precise interconnection with adjacent elements of the circuit. GRA

N77-14354# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
A FAILURE RATE MODEL FOR BURN-IN THROUGH STEADY STATE
Paul B. Moranda 1976 12 p refs Presented at the Joint Natl. Meeting, ORSA/TIMS Philadelphia, 31 Mar. - 2 Apr. 1976
(Contract F44620-74-C-0008; AF Proj. 9769)
(AD-A026415; AFOSR-76-0176TR) Avail: NTIS HC A02/MF A01 CSCL 09/3

Two failure rate models for the so-called 'burn in' phase have been developed. One model based on a constant-step decrease implicitly assumed a pure state (zero residual error) could be achieved. The other, based on a geometric progression in the failure rates, has an asymptotical zero failure rate. In the new model, presented here, the system error rate is composed of a combination of a rate which is constant (mid-phase) and the geometric model. Maximum likelihood equations are developed and some of the conditions for the existence of solutions are established. GRA

N77-14355# Picatinny Arsenal, Dover, N.J.
A NEW DEVELOPMENT IN RADIATION HARDENING OF MILITARY ELECTRONIC CIRCUITRY
Ruth Vogel Nicolaides and L. William Doremus 1976 13 p refs
(AD-A026140) Avail: NTIS HC A02/MF A01 CSCL 20/12

Integrated circuits and discrete semiconductor devices, although very reliable under normal environmental conditions, have a low vulnerability threshold to nuclear radiation. The highest radiation tolerance of crystalline semiconductor devices is approximately 10 to the 13th power n/sq cm and is dependent on device type and construction. A significantly new approach to radiation hardening of electronic systems, involving the application of amorphous semiconductor devices, was investigated. These devices are bistable circuit elements exhibiting switching or memory properties and can be used as the only active elements in binary logic circuitry. The primary damage caused by neutrons is the generation of crystal defects which act as electron/hole traps, recombination centers and scattering centers, and reduce minority carrier lifetime. Since amorphous materials are disordered structures, a high radiation tolerance is expected. The switching/memory elements are bulk effect devices without p-n junctions, and the electrical transport is governed by majority carriers. GRA

N77-14356# Air Force Weapons Lab., Kirtland AFB, N.Mex.
IRRADIATED ELECTRONIC RELIABILITY STUDY Final Report
Bernd Deue and Chris Ashley Jul. 1976 18 p refs
(AF Proj. 8809)
(AD-A027450; AFWL-TR-76-125) Avail: NTIS HC A02/MF A01 CSCL 09/3

In 1969 the U.S. Air Force withdrew approximately 790 modules of electronics circuitry, in the form of 10 operational guidance and control systems, from the field and irradiated them. A module consists of an average of about 25 small scale integrated circuits, 45 discrete semiconductor devices, and miscellaneous R, L, and C components. The average total dose used was approximately 1800 rads(Si) of 4.2 MeV mean bremsstrahlung. This dose was distributed over 8 to 10 pulses per system, with average half power width approximately 72 nanoseconds per pulse. The average (over all modules) maximum half-power-point-rate was about 8.4E9 rads(Si)/sec. The irradiated modules were then returned to field service. A primary objective of the radiation tests was to determine the photocurrent induced latchup susceptibility of the guidance and control system to known short duration pulses of radiation. The purpose of this report, in contrast, is to indicate how that radiation testing affected the longer term reliability of the electronics circuitry via certain other mechanisms, assuming that any immediately obvious radiation damage was corrected. Six years later, in 1975, failure and repair records were analyzed statistically to determine whether the radiation had functionally affected the electronics. There remained 650 irradiated modules available for this statistical analysis after culling. These modules had been carefully associated by individual serial number with approximately 1050 modules in field use which were not irradiated and which served as controls.
Author (GRA)

N77-14357# Hughes Research Labs., Malibu, Calif.
CHARACTERIZATION OF INSULATING REGIONS CREATED IN SILICON-ON-SAPPHIRE BY ION IMPLANTATION Final Technical Report, 1 Oct. 1974 - 31 Aug. 1975
Douglas M. Jamba, Robert G. Wilson, Eli Harari, and Kenneth G. Aubuchon Nov. 1975 93 p refs
(Contract N00014-75-C-0080)
(AD-A026517) Avail: NTIS HC A05/MF A01 CSCL 20/12

This research program was concerned with the fabrication of isolation (electrically insulating) regions in silicon-on-sapphire (SOS) wafers for application to integrated circuit technology, radiation hard MOS IC's in particular. GRA

N77-14358# Air Force Academy, Colo. Frank J. Seiler Research Lab.
ANALYSIS OF ELECTRONIC COMPONENT DAMAGE DUE TO EMP Final Technical Report, Jan. - Jun. 1976
Robert B. Bell Jun. 1976 60 p refs
(AF Proj. 7903)
(AD-A026364; FJSRL-TR-76-009) Avail: NTIS HC A04/MF A01 CSCL 09/1

Carbon composition, metal film, carbon film, and metal oxide type resistors, damaged with electromagnetic pulses (EMP) of 0.1 microsec to 10 microsec, have been examined using a scanning electron microscope (SEM). Failure mechanisms as a function of EMP pulsewidth were investigated with specific interest in arcing failure at short pulsewidths. Evidence of arcing damage was found in all three film type resistors associated with the helix trimming cut in the film layer. Theoretical electric field potential profiles of the resistive film layer are supported by SEM photographs. This project was supported by AFWL/DYX, P.O. AFWL 76-201, through Frank J. Seiler Research Laboratory, W.U. 7903-03-88. Author (GRA)

N77-14359# Harry Diamond Labs., Adelphi, Md.
A RUGGED MICROWAVE ACOUSTIC DELAY LINE WITH INTEGRAL MATCHING
Stuart I. Lieberman Feb. 1976 32 p refs
(DA Proj. 1W2-62301-A-300; HDL Proj. A20435)
(AD-A027686; HDL-TR-1738) Avail: NTIS HC A03/MF A01 CSCL 09/1

The characteristics are shown for a rugged, integrally matched bulk delay line that incorporates the entire transducer and matching structure on the end surfaces of the delay line rod. The significant elements in designing a bulk delay line for a specific application are discussed, along with pertinent fabrication

techniques. The integrated matching structure produces a 10-percent bandwidth with a VSWR less than 3:1.
Author (GRA)

N77-14360# Harry Diamond Labs., Adelphi, Md.
ADVANCED ELECTRO-OPTICAL SYSTEM HARDENING: PHASE 1: EMP/IEMP SUSCEPTIBILITY OF HOST SENSOR ELECTRONIC COMPONENTS Technical Report, 1 Jul. 1973 - 31 Jul. 1974
William L. Vault and Leroy Harper Dec. 1975 84 p refs
(DA Proj. 1W3-62306-AH-72)
(AD-A027136; HDL-TR-1722) Avail: NTIS HC A05/MF A01 CSCL 09/1

This report presents the results of a study to determine the modes and mechanisms of semiconductor component degradation and failure resulting from submicrosecond electrical stress transients and ionizing nuclear radiation. The major area of investigation was the characterization of device degradation in the discrete bipolar and unipolar devices and microcircuits stressed with high current and voltage transients in the submicrosecond time regime. In order to accomplish this objective, an extensive program of experimental device modeling studies were performed. The experimental program consisted of a variety of EMP and combined-effects simulation experiments on the following device types: 1N821, 1N914, 1N3066, and LM113 diodes; 2N2484 and 2N2605 transistors; G118 MOSFET's, 2N4392 and 2N5434 JFET's; HA2605, LM101, and LM108 Operational Amplifiers; DG143, LM111, DM8800, SN54L00, and SN54L-122 microcircuits. Approximately 300 devices were tested in this program. Tests were performed with square electric waveforms and ionizing radiation dose rates of 10 to the 10th power rads(Si)/s. Again testing has shown that microcircuits in general are more vulnerable than discrete components. Author (GRA)

N77-14361# USCC/CENTRALAB, Los Angeles, Calif.
MANUFACTURING METHODS AND TECHNOLOGY PROJECT TO ESTABLISH AND IMPROVE THE PRODUCIBILITY OF SILK SCREENING AND LAYERING OF CERAMIC DIELECTRIC CAPACITORS Quarterly Progress Report, 1 Jan. - 1 Apr. 1976
Howard U. Taylor 1 Apr. 1976 21 p
(Contract DAAB07-75-C-0041)
(AD-A027301; Rept-76-05-03; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 09/1

A summary manufacturing methods and technology engineering for silk screening and layering three dielectric capacitor types is presented. Chip capacitors to be manufactured using .0005 inch dielectric rated at 50 volts at a pro-dunction rate of 5,000 units per day. Internal electrodes shall be of a basemetal or alloy that will provide for an objective of 80% cost reduction from the use of palladuim. End terminations shall be of the same material and must be capable of immersion for seconds at 500F in 60/40 solder. GRA

N77-14362# Purdue Univ., Lafayette, Ind.
THE EFFECTS OF SUBSTRATE COMPOSITION ON THICK FILM CIRCUIT RELIABILITY Quarterly Technical Report, 1 Feb. - 30 Apr. 1976
R. W. Vest 31 May 1976 20 p
(Contract N00019-76-C-0354)
(AD-A027268; QTR-1) Avail: NTIS HC A02/MF A01 CSCL 09/1

The print and fire processing of thick film circuits ensures that there will always be some degree of chemical interaction between the film and the substrate, because all common substrate materials are soluble to some degree in the glass used in thick film inks. This interaction is primarily responsible for the development of adhesion between the thick film resistor and the substrate. By virtue of the resistor-substrate interaction, the composition of the glass is changed, and as a consequence all of the physical properties of the glass will change to some extent. This research program is directed toward the determination of the effects of the major constituent, common additives, and impurities in alumina substrates on the kinetics of microstructure development, electrical characteristics and the adhesion of thick film resistors. GRA

N77-14363# Naval Research Lab., Washington, D.C.
INVESTIGATIONS OF DIELECTRIC-ROD FOCUSING FOR TRAVELING-WAVE TUBES Final Report
S. T. Smith and J. T. Jensen, Jr. Jun. 1976 26 p refs
(NRL Proj. R08-03; RR0210346)
(AD-A027528; NRL-MR-3311) Avail: NTIS HC A03/MF A01 CSCL 09/1

Relativistic electron-beam experiments by others have shown that thousands of amperes of field-emission beam current can be strongly contained and guided along the surface of a dielectric rod in vacuum. The report describes experiments to adapt this method to one-ampere, 8 to 15 kV electron beams to be used in military applications of traveling-wave tubes. Results indicate that a plasma flare forms along the dielectric rod due to field emission induced breakdown. Electron emission occurs from the plasma at the end of the rod due to lateral conductivity of the plasma surrounding the dielectric rod. The dielectric rod acts as an extension of the cathode. This proposed explanation rules out the use of a dielectric rod as a focusing device within the microwave circuit, but the dielectric rod could possibly be useful for forming and guiding the beam to the entrance of the circuit. A titanium film electrode was used as a low-voltage trigger mechanism to initiate the plasma discharge. Such a trigger device can be used to eliminate a high-voltage high-power modulator and also to achieve consistent triggering from pulse to pulse. GRA

N77-14364# Intelcom Rad Tech, San Diego, Calif.
CABLE RESPONSE SOLUTION TECHNIQUES FOR THE SYSTEM-GENERATED ELECTROMAGNETIC PULSE ENVIRONMENT. VOLUME 2: PRELIMINARY ESTIMATE OF PHOTON EXCITATION OF MULTICONDUCTOR CABLES Final Report
Monte Wilson and Paul Trybus Kirtland AFB, N. Mex. AFWL May 1976 55 p refs
(Contract F29601-74-C-0039; AF Proj. 4995)
(AD-A026897; INTEL-RT-8111-078-Vol-2; AFWL-TR-75-174-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 09/1

An investigation was made to determine if the photon induced differential voltages between conductors in a multiconductor cable can be a significant drive term when compared to the common mode excitation of the cable. GRA

N77-14365# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
PARAMETER SENSITIVITY ANALYSIS OF A HIGH-VOLTAGE, VAPORIZATION-COOLED, THREE-PHASE, CORE-TYPE TRANSFORMER M.S. Thesis
Edgar L. Dove Jun. 1976 143 p refs
(AD-A027260; GE/EE/76-8) Avail: NTIS HC A07/MF A01 CSCL 09/1

This parameter sensitivity analysis considers which independent design parameters have the most influence upon the determination of the weight and volume of a high-voltage, vaporization-cooled, three-phase, core-type transformer. The analysis is conducted through the use of a computer program which given a set of independent design parameters calculates a consistent set of values for the transformer's dependent design parameters. Two of the dependent design parameters are weight and volume. Initially, the weight and volume are determined for a reasonable set of independent design parameters. Then each independent design parameter is varied while all other independent parameters are held constant. With the weight and volume of the initial design as the common reference points, the comparison of the graphs of weight and volume as functions of the individually varied independent design parameters is the basis of the analysis. The analysis shows that the independent design parameters which most influence the determination of the weight and volume of the transformer are the power-out of the transformer, voltage-in, voltage-out, frequency of operation, number of inside secondary layers, maximum flux densities, conductor cooling rates, and the parameters which specify the core leg cross sectional areas. Author (GRA)

N77-14366# Joint Publications Research Service, Arlington, Va.
ELECTRICAL COMMUNICATIONS ENGINEERING AND

TECHNICAL HANDBOOK
I. Ye. Golubtsova, ed. 4 Jan. 1977 300 p refs Transl. into ENGLISH from the book "Inzhenerno-tekhnicheskiy spravochnik po elektrosvyazi", Moscow, 1973 p 7-40, 94-231, 232-295, 425-463
(JPRS-68437) Avail: NTIS HC A13/MF A01

Data on the construction of rural telephone networks and exchanges, multiplex equipment and telephone exchange equipment are presented. Author

N77-14054*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE EFFECT OF DIRECT CURRENT BIAS IN THE COMPUTATION OF POWER SPECTRA
E. R. Rodemich *In its* The Deep Space Network 15 Dec. 1976 p 53-57 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N77-14367 Polish Academy of Sciences, Warsaw.
MOMENT OF FORCE ACTING ON A BODY MOVING IN A STREAM FROM A PUNCTUAL CORPUSCULAR SOURCE [MOMENT SILY DZIALAJACY NA CIALO PORUSZAJACE SIE W STRUMIENIU PUNKTOWEGO ZROLA KORPUSKULARNEGO]
Stanislaw Kosowski 19 Dec. 1976 28 p refs In POLISH
Avail: Issuing Activity

The reaction of two moving bodies in a free molecular medium in the instance when they are in flat motion on circular or elliptical paths is discussed. One of the bodies was replaced by a point. The presence of the medium was formed that the point representing the body is a particle emitting source. The reaction was unidirectional, i.e., the source affects the body, while the body does not affect the source. The problem of moment of force is described to reveal new physical knowledge derived from a simplified version of the general problem. Author

N77-14368 Delaware Univ., Newark.
THE RELATION BETWEEN THERMAL TRANSPIRATION AND SURFACE DIFFUSION IN POROUS MEDIA Ph.D. Thesis
Dady Burjor Dadyburjor 1976 117 p
Avail: Univ. Microfilms Order No. 76-24257

From an analysis of the kinetic theory of gas flows in porous media, a relation is derived between the surface permeability and the magnitude of the steady state pressure difference across a porous solid subjected to a temperature difference. It is found that the thermal transpiration coefficient, defined to be the ratio of the nondimensional temperature difference to the nondimensional pressure difference, can be written as a second order polynomial in the absolute pressure. Dissert. Abstr.

N77-14369 Stanford Univ., Calif.
MATHEMATICAL MODELLING OF SINGLE-PHASE NONISOTHERMAL FLUID FLOW THROUGH POROUS MEDIA Ph.D. Thesis
Paul Gardiner Atkinson 1976 208 p
Avail: Univ. Microfilms Order No. 76-25972

A series of mathematical models was developed to describe heat transfer in laboratory experiments using cylindrical cores in a Hassler-type coreholder. Analytical solutions were derived and the behavior of these solutions was studied to determine the interaction of the heat transfer mechanisms in laboratory cores. The mathematical models were evaluated by comparison of calculated results with published experimental data. Various conclusions resulting from the comparison are: (1) heat convection due to liquid flow, and heat losses from the core are important factors in the transport of energy for all times; (2) at early and intermediate times, the heat losses to the environment are transient in nature, while at long times they become steady (the transients were controlled by a film coefficient between the core and coreholder). Dissert. Abstr.

N77-14370 Tennessee Univ., Knoxville.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF CONFINED, TWO-STREAM VARIABLE DENSITY, TURBULENT JET MIXING WITH RECIRCULATION Ph.D. Thesis
Roy James Schulz 1976 392 p
Avail: Univ. Microfilms Order No. 76-24857

The jet mixing with recirculation was confined within an axisymmetric duct that simulated a combustor configuration. The recirculating flow fields in the combustor simulator were the result of coaxial jet mixing between a central or primary air stream that entered the duct with a nominal velocity of about 650 ft/sec and an annular secondary stream of hydrogen that entered the duct with either of three nominal velocities, 13, 23, or 46 ft/sec, depending upon desired test conditions. The results of the experimental investigation are the first known sets of detailed measurements of the time-mean fields of this class of variable density turbulent flows. The experimental data thus obtained were radial distributions of mean axial velocity and hydrogen mass fraction, axial distributions of mean wall static pressures, mean axial velocity on the duct centerline, and mean hydrogen mass fraction on the wall and on the duct centerline. Dissert. Abstr.

N77-14371 Institute of Paper Chemistry, Appleton, Wis.
AN INVESTIGATION OF TIME-MEAN VELOCITY AND CONSISTENCY DISTRIBUTIONS IN A FIBER SUSPENSION JET Ph.D. Thesis
David Sloan Walseth 1976 183 p
Avail: Univ. Microfilms Order No. 76-23967

An experimental apparatus was developed for the study of an axially symmetric submerged and turbulent jet discharged into a cylindrical tank. Water jets were used to check the effects of the confining tank on the jet velocity profiles and momentum fluxes. Suspension jets of nylon 12 fibers in water were then investigated to determine if the presence of fibers would significantly affect the velocity profiles, momentum fluxes, and consistency distributions. Local time-mean velocities and consistencies of the suspension jets were measured by a water purged pitot tube and a water purged optical probe, respectively. The latter was calibrated in a flowing fiber suspension of known velocities and consistencies. Dissert. Abstr.

N77-14372*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTUMESCENT-ABLATOR COATINGS USING ENDOTHERMIC FILLERS Patent Application
Paul M. Sawko and Salvatore R. Riccitiello, inventors (to NASA) Filed 23 Dec. 1976 30 p
(NASA-Case-ARC-11043-1; US-Patent-Appl-SN-753964) Avail: NTIS HC A03/MF A01 CSCL 20D

An improved intumescent composition is provided for insulating a substrate against heat which consists of a mixture of an endothermic filler with an intumescent composition which is composed of an intumescent agent and a polymeric binder system. The composition of the invention employs a filler such as ammonium oxlate, potassium fluoborate, ammonium fluoborate or zinc borate in combination with a base intumescent composition which contains 4,4-dinitrosulfanilide or the ammonium salt of 1,4-nitroaniline-2-sulfonic acid in a polymeric binder system. The endothermic characteristics of the filler moderate the heat emitted upon the thermal decomposition of the intumescent agent in an applied intumescent coating. NASA

N77-14373# Technische Hogeschool, Delft (Netherlands).
AN ANALYTICAL SOLUTION FOR THE PROFILE AND VOLUME OF A SMALL DROP OR BUBBLE SYMMETRICAL ABOUT A VERTICAL AXIS
A. K. Chesters Dec. 1976 34 p refs Submitted for publication
(WTHD-93) Avail: NTIS HC A03/MF A01

A solution for the profile of a small drop or bubble, symmetrical about a vertical axis and at rest in a second fluid, is obtained

as a first order perturbation of a circle. At the end of the drop opposite the apex, the perturbation approach breaks down and a matching zero gravity solution is used. The results agree with numerical solutions and indicate that the pendant drop profile of maximum volume fitting a given small vertical tube intersects the exit plane at very nearly 90 deg. This enables the maximum volume to be determined accurately from a force balance. Author

N77-14374*# TRW Systems Group, Redondo Beach, Calif.
FLIGHT DATA ANALYSIS AND FURTHER DEVELOPMENT OF VARIABLE-CONDUCTANCE HEAT PIPES
J. E. Eninger, D. K. Edwards, and E. E. Luedke Nov. 1976 52 p refs
(Contract NAS2-8310)
(NASA-CR-137953; RR-2) Avail: NTIS HC A04/MF A01 CSCL 20D

The work focuses on the mathematical modeling of three critical mechanisms of heat-pipe operation: (1) the effect that excess liquid has on heat-pipe performance; (2) the calculation of the dryout limit of circumferential grooves; (3) an efficient mathematical model for the calculation of the viscous-inertial interaction in the vapor flow. These mathematical models are incorporated in the computer program GRADE II, which is described. Author

N77-14375*# TRW Defense and Space Systems Group, Redondo Beach Calif.
COMPUTER PROGRAM GRADE 2 FOR THE DESIGN AND ANALYSIS OF HEAT-PIPE WICKS
J. E. Eninger and D. K. Edwards Nov. 1976 114 p refs
(Contract NAS2-8310)
(NASA-CR-137954; TRW-26263-6026-RU-00) Avail: NTIS HC A06/MF A01 CSCL 20D

This user's manual describes the revised version of the computer program GRADE(1), which designs and analyzes heat pipes with gradedporosity fibrous slab wicks. The revisions are: (1) automatic calculation of the minimum condenser-end stress that will not result in an excess-liquid puddle or a liquid slug in the vapor space; (2) numerical solution of the equations describing flow in the circumferential grooves to assess the burnout criterion; (3) calculation of the contribution of excess liquid in fillets and puddles to the heat-transport; (4) calculation of the effect of partial saturation on the wick performance; and (5) calculation of the effect of vapor flow, which includes viscousinertial interactions. Author

N77-14376*# DCW Industries, Sherman Oaks, Calif.
DEVELOPMENT OF RELAXATION TURBULENCE MODELS
C. M. Hung Washington NASA Dec. 1976 46 p refs
(Contract NAS2-8995)
(NASA-CR-2783) Avail: NTIS HC A03/MF A01 CSCL 20D

Relaxation turbulence models have been intensively studied. The complete time dependent mass averaged Navier-Stokes equations have been solved for flow into a two dimensional compression corner. A new numerical scheme has been incorporated into the developed computed code with an attendant order of magnitude reduction in computation time. Computed solutions are compared with experimental measurements of Law for supersonic flow. Details of the relaxation process have been studied; several different relaxation models, including different relaxation processes and varying relaxation length, are tested and compared. Then a parametric study has been conducted in which both Reynolds number and wedge angle are varied. To assess effects of Reynolds number and wedge angle, the parametric study includes the comparison of computed separation location and upstream extent of pressure rise; numerical results are also compared with the measurements of surface pressure, skin friction and mean velocity field. Author

N77-14377*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THRFE-DIMENSIONAL POTENTIAL FLOW OVER HILLS AND OVAL MOUNDS
Robert Siegel Washington Dec. 1976 36 p refs
(NASA-TN-D-8375; E-8769) Avail: NTIS HC A03/MF A01 CSCL 20D

An analysis was made of the potential flow behavior for an initially uniform flow passing over a single axisymmetric hill, an oval mound, and a combination of two hills. Small perturbation theory was used, and the resulting Laplace equation for the perturbation velocity potential was solved by using either a product solution or a Green's function. The three dimensional solution is of interest in calculating the pressure distribution around obstacles, the flow of pollutants carried by the wind, and the augmentation of wind velocity for windmill siting. The augmentation in velocity at the top of a hill was found to be proportional to the hill height relative to a characteristic width dimension of the hill. An axisymmetric hill produced about 20 percent less velocity increase than a two dimensional ridge having the same cross-sectional profile. Author

N77-14378# European Space Agency, Paris (France).
HEAT PIPES, VOLUME 2
Sep. 1976 205 p refs Proc. of the CNR 2d Intern. Conf., Bologna, 31 Mar. - 2 Apr. 1976; co-sponsored by AIAA, ESA and EURATOM
(ESA-SP-112-Vol-2) Avail: NTIS HC A10/MF A01

Topics dealt with are the following: gravity-assisted heat pipes, low temperature heat pipes, liquid metal heat pipes, heat pipe dynamics, variable conductance heat pipes, rotating heat pipes, heat pipe materials, evaporation heat transfer, terrestrial applications, zero gravity testing, and spacecraft applications. For individual titles, see N77-14379 through N77-14391.

N77-14379 Perkin-Elmer Corp., Danbury, Conn. Optical Technology Div.
EXTENDED CRYOGENIC PERFORMANCE OF LOBAR WICK HEAT PIPE/RADIATOR
A. A. Cenkner, Jr., B. E. Nelson, and W. Petrie *In* ESA Heat Pipes, Vol. 2 Sep. 1976 p 683-697 refs (For primary document see N77-14378 05-34)

Two series of cryogenic-vacuum tests were performed as part of a continuing research program aimed at developing lightweight, reliable, and efficient Lobar Wick heat pipe/radiator or heat pipe/solid cryogen cooling systems for earth resource and meteorological spaceborne detectors. In the first series, a 640 cm long nitrogen heat pipe/radiator was tested from 74 to 116 K; pipe performance was isothermal to approximately 1 K. During the second, a thermal evaluation was made on the feasibility of converting a complex focal plane assembly into an integral part of a heat pipe cooling system. High power localized heating was applied along the 1.3 cm wide lip on an arc-shaped evaporator that was 42.4 cm long and 7.6 x 10.24 sq cm in cross section. Performance indicates that design goals of less than 0.5 K longitudinal and 1.0 K lateral gradients, with + or - 1 K temporal stability during transient loadings, can be achieved with power levels up to 20 watts. While no attempt was made to identify the upper heat transport limit of the Lobar Wick, 31.3 watts was successfully carried by nitrogen.
Author (ESA)

N77-14380 Institute of Physics and Power Engineering, Obninsk (USSR).
OPERATION PECULIARITIES OF LOW TEMPERATURE HEAT PIPES WITH CRIMPED CAPILLARY STRUCTURE
M. I. Ivanovsky, Y. A. Ilyin, F. F. Kolgotin, V. I. Korneev, V. V. Privesentsev, B. I. Rybkin, V. I. Serbin, Y. Y. Sergeev, E. M. Sidorenko, and V. P. Sorokin *In* ESA Heat Pipes, Vol. 2 Sep. 1976 p 669-710 refs (For primary document see N77-14378 05-34)

The capillary structure considered is made of crimped metallic gauze. It can easily be manufactured and allows provision of a sufficiently high heat transfer in the heat pipe. Being non-uniform such a structure remains stable under certain conditions at underfilling with coolant. Some operational peculiarities of the heat pipes with crimped capillary structure, having two channels of different dimensions, were analyzed both theoretically and on the basis of experiments with various low temperature liquids. Author (ESA)

N77-14381 National Research Inst. for Machine Design, Bechovice (Czechoslovakia).
HEAT PIPES FOR THE TEMPERATURE RANGE FROM 200 TO 600 C
F. Polasek and P. Stulc *In* ESA Heat Pipes, Vol. 2 Sep.

1976 p 711-732 refs (For primary document see N77-14378 05-34)

Suitable working fluids for heat pipes in the temperature range 200 to 600 C were investigated for possible application to industry. Sulfur with addition, it was found, permits operation of the heat pipe in the whole range. Besides the favorable thermophysical properties of liquid sulfur, e.g. specific mass, evaporation heat, and surface tension, some properties rapidly change in the required temperature range, mostly the dynamic viscosity of the liquid phase. By using suitable additives (iodine) the basic reduction of the dynamic viscosity by three orders was obtained and thus extension of the working range to cover 200 to 600 C. ESA

N77-14382 Institute of Physics and Power Engineering, Obninsk (USSR).

INVESTIGATION OF HEAT TRANSFER CAPILLARY LIMIT IN SODIUM HEAT PIPES

M. N. Ivanovsky, V. I. Subbotin, V. P. Sorokin, I. V. Yagodkin, B. A. Tchulkov, and L. M. Kuznetsova *In* ESA Heat Pipes, Vol. 2 Sep. 1976 p 733-739 refs (For primary document see N77-14378 05-34)

Development of engineering methods for the calculation of heat transfer capillary limit and experimental check of the application range of such procedures are discussed. For high-temperature heat pipes it is important to study the region of operating temperatures at which vapor compressibility can influence the calculational relationships. The results of an experimental check of maximum heat transfer values obtained from numerical calculation procedures with and without consideration for vapor compressibility are presented for sodium heat pipes. Author (ESA)

N77-14383 Institute of Physics and Power Engineering, Obninsk (USSR).

SOME FEATURES OF START-UP OF ALKALI METAL HEAT PIPES

M. N. Ivanovsky, V. P. Sorokin, V. I. Subbotin, I. V. Yagodkin, and B. A. Tchulkov *In* ESA Heat Pipes, Vol. 2 Sep. 1976 p 741-750 refs (For primary document see N77-14378 05-34)

The starting features connected with both an incomplete filling of complex wicks and the formation of some bubbles were analyzed for sodium heat pipes. The influence of gas availability in a pipe on the working ability of the capillary structures is considered. ESA

N77-14384 Institute of Physics and Power Engineering, Obninsk (USSR).

INVESTIGATIONS OF NONSTEADY-STATE PROCESSES AT CRYOGENIC HEAT PIPE OPERATION

M. I. Ivanovsky, Y. A. Ilyin, V. I. Korneev, V. V. Privesentsev, V. I. Serbin, Y. Y. Sergeev, E. M. Sidorenko, and V. P. Sorokin *In* ESA Heat Pipes, Vol. 2 Sep. 1976 p 751-759 refs (For primary document see N77-14378 05-34)

Two problems are treated experimentally, i.e., dynamics of filling the capillary structure of heat pipes with fluid after drying out and capillary limitations for heat transfer under nonsteady thermal conditions. The experiments were performed on heat pipes with ammonia and Freon-22. An approximate analytical solution for the problem of filling the heat pipe capillary structure with coolant is obtained from analysis of Darcy's equation. Dynamics of the filling procedure are determined by design parameters of the heat pipe and thermophysical properties of the coolant as well as the density of the supplied heat flux, wall temperature superheating, and heat pipe position in the gravitational field. Author (ESA)

N77-14385 Indian Inst. of Tech., Madras. Dept. of Chemical Engineering.

TRANSFER FUNCTION ANALYSIS OF HEAT PIPES

A. Rajakumar and P. R. Krishnaswamy *In* ESA Heat Pipes, Vol. 2 Sep. 1976 p 761-772 refs (For primary document see N77-14378 05-34)

Dynamic characteristics of heat pipes are described in terms of frequency response through an unsteady-state model. A simplified model was established based on the following characteristics: heat conduction through the container wall, heat transfer in the liquid-filled wick, vaporization and condensation, vapor flow through the core, and liquid flow through the wick. For the purpose of the analysis a water heat pipe with floating boundary conditions was assumed. Detailed frequency domain dynamics of heat pipes were established quantitatively. The response curves are definitive in differentiating and describing the effects of system parameters on the dynamics. ESA

N77-14386 Naples Univ. (Italy). Inst. di Fisica Tecnica.

WETTING AND SURFACE PROPERTIES OF REFRIGERANTS TO BE USED IN HEAT PIPES

F. Reale and M. Cannaviello *In* ESA Heat Pipes, Vol. 2 Sep. 1976 p 773-792 refs (For primary document see N77-14378 05-34)

A simple and accurate method is presented for measuring surface properties of fluids, properties such as surface tension and other related quantities, e.g., contact angles of fluids to solid walls. Surface tension and contact angles are properties determining transport and capillary phenomena which take place in heat pipes. A number of measurements is reported for some organic coolants. ESA

N77-14387 National Research Inst. for Machine Design, Bechovice (Czechoslovakia).

HEAT PIPES WITH A NON-CONDENSABLE GAS AND THEIR APPLICATION IN NUCLEAR APPARATUS AND INSTRUMENTS

F. Polasek and P. Stulc *In* ESA Heat Pipes, Vol. 2 Sep. 1976 p 793-801 refs (For primary document see N77-14378 05-34)

Results of operating characteristic measurements are given for stainless steel heat pipes filled with H_2O + Ar and Na + Ar. The stabilizing heat pipes were used as heat exchanging elements in irradiation capsule prototypes for structural materials testing in the nuclear reactor active zone and in the vacuum distilling unit of 100 l crude sodium capacity. ESA

N77-14388 McDonnell-Douglas Astronautics Co., Richland, Wash.

HEAT PIPES FOR THE TRANS-ALASKA PIPELINE

E. D. Waters *In* ESA Heat Pipes, Vol. 2 Sep. 1976 p 803-814 refs (For primary document see N77-14378 05-34)

The reason for cooling the support members of the above-ground portion of the trans-Alaska pipeline is discussed, along with studies that led to use of heat pipes for seasonal refrigeration of the permafrost. The physical and thermal characteristics of the heat pipes, which range from 9 to 23 m in length, are described. Manufacturing approaches to producing such pipes at rates of more than 500 units per day are discussed. Results of heat pipe installation in a segment of the pipeline during late 1974 and early 1975 are presented. Author (ESA)

N77-14389* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE INTERNATIONAL HEAT PIPE EXPERIMENT

Roy McIntosh, Stanford Ollendorf, Allan Sherman, and William Harwell (Grumman Aerospace Corp., Bethpage, N. Y.) *In* ESA Heat Pipes, Vol. 2 Sep. 1976 p 815-837 refs (For primary document see N77-14378 05-34)

CSCL 20D

On October 4, 1974, the International Heat Pipe Experiment was launched aboard a Black Brant sounding rocket from White Sands, New Mexico. The flight provided six min of near zero gravity during which a total of ten separate heat pipe experiments was performed. The fifteen heat pipes tested represent some of the latest American and European technology. This flight provided the first reported zero gravity data on cryogenic and flat plate vapor chamber heat pipes. Additionally, valuable design and engineering data were obtained on several other heat pipe configurations. The payload and several of its experiments are discussed. Author (ESA)

N77-14390 Societe Nationale Industrielle Aerospatiale, Cannes (France).

DEVELOPMENT OF SPACE APPLICATIONS OF HEAT PIPES AT AEROSPATIALE

I. Martinez, B. Moschetti, and J. P. Mathieu (SABCA) *In* ESA Heat Pipes, Vol. 2 Sep. 1976 p 839-863 (For primary document see N77-14378 05-34)

Work on the development and application of conventional heat pipes and variable conductance heat pipes for spacecraft applications is surveyed. Heat pipes developed and tested permit covering a wide range of heat transfers from a few W x m to more than a hundred W x m. Calculation methods for systems including heat pipes were developed and confirmed by numerous tests. The wide choice of solutions described includes: milled structures with possible crimping/brazing of heat pipes on different materials: aluminum, beryllium; honeycomb structures with heat pipes; and segmented or continuous structures for variable conductance heat pipe systems. ESA

N77-14391 GEC-Marconi Electronics Ltd., Chelmsford (England). Research Lab.

HEAT PIPE AND SPACE RADIATOR DEVELOPMENTS

J. B. Goodacre and G. D. Griffiths (Marconi Space and Defence Systems Ltd., Portsmouth, Engl.) *In* ESA Heat Pipes, Vol. 2 Sep. 1976 p 865-872 (For primary document see N77-14378 05-34)

Developments in connection with the manufacture of artery wick pipes are reported, mentioning the use of computer aided design. A study on the design of heat pipe radiators to be used onboard direct broadcasting communications satellites is also reported. ESA

N77-14392# Sandia Labs., Albuquerque, N.Mex.

FLIGHT TEST EVALUATION OF ROLL TORQUE ON TAPE-WRAPPED CARBON PHENOLIC HEATSHIELDS

J. K. Kryvoruka Mar. 1976 30 p refs Presented at the Reentry Body Aerodynamic Response Meeting, Colorado Springs, Colo., 8 Jan. 1976

(Contract AT(29-1)-789)

(SAND-75-8766; Conf-760117-1) Avail: NTIS HC A03/MF A01

The purpose of the test program was to evaluate, in a controlled environment, the roll torque producing effect of an ablating tape wrapped carbon phenolic heatshield. The boost system, a Talos-Terrier-Recruit rocket, delivered the reentry vehicle to conditions approximating full-scale reentry while providing nominal payload separation. Flight instrumentation, designed to evaluate the vehicle's aerodynamic performance and thermal response, indicates the flight environment was severe enough to produce the desired level of ablation and that significant rolling moments were obtained. In addition, the vehicle was recovered intact for postflight inspection. ERA

N77-14393# California Univ., Livermore. Lawrence Livermore Lab.

MONITORING FLUID FLOW BY USING HIGH-FREQUENCY ELECTROMAGNETIC PROBING

R. J. Lytle, D. L. Laser, E. F. Laine, and J. D. Salisbury 5 Jan. 1976 54 p refs Sponsored by ERDA

(UCRL-51979) Avail: NTIS HC A04/MF A01

High frequency electromagnetic probing is proposed as a means of monitoring the rate and direction of flow of fluids injected into the ground. This method has potential for providing more detailed information than procedures presently used. The experimental technique, data reduction algorithms, test of concept experimental results, and a discussion of possible problems in using this technique are discussed. This technique has known applications in oil reservoir engineering, in situ coal gasification, and hydrology studies concerning underground storage of chemical wastes. ERA

N77-14394# Technisch Physisch Dienst TNO-TH, Delft (Netherlands). Afdeling Optiek.

HOLOGRAPHIC INVESTIGATION OF BOUNDARY LAYER AND CAVITATION PHENOMENA [HOLOGRAFISCH ONDERZOEK AAN GRENSLAAG- EN CAVITATIEVERSCHIJNSELEN]

N. B. Sies-Oosterveld and R. L. VanRenesse 14 Oct. 1975 28 p refs In DUTCH

(Contract A70/KM/154)

(TPD-1975-0-5; Rept-505.107; TDCK-66923) Avail: NTIS HC A03/MF A01

The separation area and cavitation phenomena around two different bodies were investigaged in a high speed water tunnel. The bodies had a hemispherical and a flat nose. Holograms were recorded with a frequency-doubled ruby laser line to obtain higher resolution. The separation area was visualized by the injection of a salt solution. The influence of the polymer Polyox WSR-301 on the separation and cavitation was also studied. A first result of the investigation provides an explanation for the effect of polymers on cavitation. Further results are to be evaluated. The measurement of the bubble spectra according to the Keller method (light scattering) is discussed. ESA

N77-14395# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

THERMAL INSULATION BY INJECTION OF UREA FOAM IN BUILDING STRUCTURES

Jul. 1976 9 p Transl. into ENGLISH from Svensk Byggnorm-Uppl ysning, Statens Planverk, no. 15, 1968

(AD-A027018; CRREL-TL-532) Avail: NTIS HC A02/MF A01 CSCL 13/3

This report gives information concerning improvement of thermal insulation in existing buildings by injection of urea foam in hollow portions of the structures. When performed and used correctly, insulation with urea formaldehyde resin foam can result in considerably improved thermal insulation, both in structures with high heat transfer coefficients (K-values) and in structures where the thermal insulating capability is impaired by air flow through fissures and slits. GRA

N77-14396# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.

PITOT PRESSURE PROFILE MEASUREMENT AT THE EXIT OF VERY SMALL NOZZLES Interim Report

Robert L. Varwig, Donald A. Durran, and Shaowen W. Liu 4 Jun. 1976 22 p refs

(Contract F04701-75-C-0076)

(AD-A027497; TR-0076(6240-10)-3; SAMSO-TR-76-118) Avail: NTIS HC A02/MF A01 CSCL 20/4

Pitot pressure profile measurements at the exit plane of a nozzle are used to characterize the flow properties of nozzles. For very small nozzles, where the boundary layer is a singificant part of the nozzle, the pitot pressure profile obtained when the probe is traversed across the nozzle exit displays peculiar properties. Close to the nozzle exist, at the edge of the nozzle, there are sharp peaks in the profile, and there is a lower pressure on the centerline than closer to the wall. The former effect is attributed to flow separation caused by the traversing probe, which is large relative to the scale of the flow nonuniformities, as in the case of a forward facing step. The latter effect is caused by the boundary layer, which changes the effective contour of the nozzle wall. In the 0.060-in.-diam conical nozzle of this study, the boundary layer changed the shape from conical to that approximating the first third of a Mach 6 contoured nozzle. Author (GRA)

N77-14397# Calspan Corp., Buffalo, N.Y.

WALL INTERFERENCE EFFECTS IN TRANSONIC FLOWS Final Report, 15 Jan. 1971 - 31 Dec. 1975

R. J. Vidal 1976 37 p refs

(Contract F44620-71-C-0046; AF Proj. 6813; AF Proj. 9781)

(AD-A027711; CALSPAN-AE-3059-A-1; AFOSR-76-0770TR) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report reviews the research accomplished in two sections. The first describes existing theories for predicting wall interference effects in wind tunnels with ventilated test sections to demonstrate that the existing knowledge of the wall boundary conditions precludes the application of these theories. Experimental data and theory are presented to criterize the accepted wall boundary condition for a porous wall. The second section summarizes some experimental research on transonic shock wave-turbulent boundary layer interactions and provides references to the results that have been documented. GRA

N77-14398# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

HEAT SINKS: A STUDY OF VARIABLE TYPES OF HEAT SINKS

U. Fabricius Oct. 1976 58 p refs Transl. into ENGLISH from Danish Research Center for Applied Elec., 1974 70 p

(AD-A027407; CRREL-TL-508) Avail: NTIS HC A04/MF A01 CSCL 09/3

Twelve various types of heat sinks are included in this investigation, which is stressing a comparison between the profiles rather than a comparison between manufactures. It has been examined as to how much power can be added to the heat sink at intermittent service without influencing the junction temperature of the power component to exceed a tolerated maximum temperature. Author (GRA)

N77-14399# Ohio State Univ., Columbus. Dept. of Mechanical Engineering.
TRANSIENT NATURAL CONVECTION IN AN INTERNALLY HEATED FLUID LAYER Topical Report, Jun. 1975 - Jun. 1976
F. A. Kulacki and A. A. Emara Jun. 1976 71 p refs
(Contract AT(4924)-0149)
(PB-255926/8; OSURF-NUREG-4230-1; NUREG-0078) Avail: NTIS HC A04/MF A01 CSCL 20D

An experimental study of the transient response of a horizontal fluid layer subjected to a step change in internal energy generation has been conducted to determine the time scales for the development and decay of natural convection driven solely by the internal heat release. The layer is bounded from above by a rigid, constant temperature surface and from below by a rigid, insulated surface. Two types of unsteady convection processes are considered in the study. In the first, the layer is brought to a motionless, isothermal state, and internal energy generation is suddenly started. In the second, steady natural convection is the initial state, and internal energy generation is suddenly stopped. The work will find general application in Post-accident heat removal problems in nuclear power reactors and particularly in the analysis of the thermal response of in-vessel and ex-vessel molten core retention devices. GRA

N77-14400# JAYCOR, Del Mar, Calif.
A REVIEW OF THE RATIONAL APPROACH TO TWO-PHASE FLOW MODELING
James H. Stuhmiller Jul. 1976 61 p refs Sponsored by Elec. Power Res. Inst.
(PB-255548/0; EPRI/NP-197) Avail: NTIS HC A04/MF A01 CSCL 20D

The rational approach to two phase flow modeling and attempts to contribute to this field by providing an intuitive explanation of many of the abstract mathematical results, by identifying subtleties of two-phase flow modeling that demand special consideration, and by indicating a systematic way in which an understanding of two-phase flow dynamics can be gained, are reviewed. GRA

N77-14401# McDonnell-Douglas Astronautics Co., Titusville, Fla.
FLUIDIC LAMINAR ANGULAR RATE SENSOR RESEARCH PROGRAM Final Report
George W. Roe Nov. 1975 182 p
(Contract DAAG39-75-C-0020; DA Proj. 1T1-61102-A-33B)
(AD-A027583; L0318; HDL-CR-75-020-1) Avail: NTIS HC A09/MF A01 CSCL 20/4

A program was conducted to design, build and test a series of laminar angular rate sensors (LARS), operating on gas, to determine the performance effect of various geometric parameters. The concept of flow source supply, positive pressure control ports and vent isolation from atmosphere were evaluated. Performance of the optimized LARS is compared to a baseline device. A feasibility model of a dual axis LARS was developed. Author (GRA)

N77-14402# ARO, Inc., Arnold Air Force Station, Tenn.
ANALYTICAL, NUMERICAL AND EXPERIMENTAL RESULTS ON TURBULENT BOUNDARY LAYERS Final Report, Sep. 1974 - Jan. 1975
David L. Whitfield AEDC Jul. 1976 102 p refs
(AD-A027588; ARO-PWT-TR-75-132; AEDC-TR-76-62) Avail: NTIS HC A06/MF A01 CSCL 20/4

This report describes the results of analytical, numerical, and experimental investigations of incompressible and compressible boundary layers. The subjects considered are (1) Laminar and/or turbulent numerical boundary-layer calculations in which the Reynolds stress is related to the turbulent kinetic energy; (2) an analytical investigation of turbulence near a wall which is not founded on classical mixing-length theory; (3) analytical solutions for relating velocity and temperature throughout turbulent boundary layers for nonunity Prandtl numbers; (4) a description of the data reduction of pitot pressure measurements utilizing these analytical results, and (5) the application of the numerical and analytical results to the analysis of turbulent boundary-layer measurements made in the Propulsion Wind Tunnel Facility (PWT). GRA

N77-14403# Illinois Inst. of Tech., Chicago. Dept. of Mechanics, Mechanical and Aerospace Engineering.
RELATIVE SPREADING AND STRUCTURE OF COUPLED TURBULENT THERMAL AND VELOCITY FIELDS Final Report, Jan. 1973 - Dec. 1975
John W. Way Jun. 1976 16 p refs
(Grant AF-AFOSR-2509-73; AF Proj. 6813; AF Proj. 9781)
(AD-A027651; AFOSR-76-0929TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

Brief descriptions of research accomplished under the grant Relative Spreading and Structure of Coupled Turbulent Thermal and Velocity Fields are presented in nine categories: (a) data acquisition and processing, (b) interaction of a cold and a lukewarm wake, (c) metallic films for thermal tracing, (d) point-source thermal tracer techniques, (e) dynamic temperature compensation for hot-films, (f) effect of upstream laminar wakes on blunt bodies, (g) response of split - and hot-films, (h) differential temperature measurements, and (i) circular cylinder near wake. The techniques of thermal tracing, resistance thermometry, temperature compensation, digital data acquisition and processing, conditional sampling and averaging, and phase detection and averaging are developed and combined in the experimental investigation of three fluid mechanical problems. GRA

N77-14404# Army Armament Command, Rock Island, Ill. Systems Analysis Directorate.
DYNAMICS OF LIQUID-FILLED PROJECTILES Final Report
George Schlenker Apr. 1976 131 p refs
(AD-A027665; DRSAR/SA/R-12) Avail: NTIS HC A07/MF A01 CSCL 19/1

This report presents a collection of analytic models which treat various aspects of the dynamics of liquid-filled, spin-stabilized projectiles. Several numerical examples are given applicable to eight-inch ammunition. Although idealized, these examples may provide understanding of the behavior of real systems such as the XM736 binary round. Chapter 1 examines the change in inertial characteristics with a change in liquid configuration. Chapter 2 treats the dynamics of spinup of the liquid fill. Also considered are the range and deflection sensitivity to configuration change, and the question of 'ballistic similitude' with a comparable solid-filled projectile. The distribution of energy in the liquid and an approximation for the frequency of a fundamental vibratory mode of the liquid are addressed in Chapter 3. The frequency of vibration is compared with precessional and nutational frequencies of the projectile during flight to assess the likelihood of stability problems. Insofar as the approximations made here are applicable, one can conclude that the XM736 projectile is a reasonable ballistic match to the M509. Difference in mean point of impact can be corrected by small adjustments in aiming. The XM736 is judged to be ballistically stable but will likely have a somewhat larger ballistic dispersion than either the M509 or M106 projectiles. Author (GRA)

N77-14090# Battelle Inst., Frankfurt am Main (West Germany).
HEAT FLOW, DIFFUSION AND CONVECTION IN THE TRAVELLING-SOLVENT METHOD
D. Langbein *In* ESA Mater. Sci. in Space Sep. 1976 p 223-230 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14097# Polytechnical Univ. of Madrid (Spain). Escuela Tecnica Superior de Ingenieros Aeronauticos.
FLUID-PHYSICS-MODULE EXPERIMENTS
I. Da-Riva and J. M. Ruesga (Construcciones Aeronauticas S. A.) *In* ESA Mater. Sci. in Space Sep. 1976 p 265-275 refs Sponsored by Comision Nacl. de Invest. del Espacio (For

primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14098# Polytechnical Univ. of Madrid (Spain). Escuela Tecnica Superior de Ingenieros Aeronauticos.
FLOATING ZONE UNDER REDUCED GRAVITY. AXISYMMETRIC EQUILIBRIUM SHAPES
I. MartinezHerranz *In* ESA Mater. Sci. in Space Sep. 1976 p 277-282 refs Sponsored by Comision Nacl. de Invest. del Espacio (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14099# Laboratoires d'Electronique et de Physique Appliquee, Paris Limeil-Brevannes (France).
FLUID-DYNAMICS PROBLEMS CONNECTED WITH CRYSTAL GROWTH
C. Belouet *In* ESA Mater. Sci. in Space Sep. 1976 p 283-289 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14114*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DROP DYNAMICS IN SPACE
T. G. Wang, M. M. Saffren, and D. D. Elleman *In* ESA Mater. Sci. in Space Sep. 1976 p 405-419 refs Sponsored by NASA (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01 CSCL 20D

N77-14115# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Mechanik.
SHAPING AND DEGASSING OF LIQUEFIED MATTER UNDER SIMULATED LOW AND ZERO GRAVITY
J. Siekmann *In* ESA Mater. Sci. in Space Sep. 1976 p 421-431 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14116# Naples Univ. (Italy). Aerodynamics Inst.
ZEROTH-ORDER BOUNDARY-LAYER THEORIES FOR GAS-MIXTURE FREE-CONVECTION PROBLEMS
L. G. Napolitano and S. Vetrella *In* ESA Mater. Sci. in Space Sep. 1976 p 433-445 refs (For primary document see N77-14066 05-12)
(Contract CNR-SAS-00100)
Avail: NTIS HC A22/MF A01

N77-14117# Kodak Ltd., London (England). Research Div.
CAPILLARY FORCES AND STABILITY IN ZERO-GRAVITY ENVIRONMENTS
J. F. Padday *In* ESA Mater. Sci. in Space Sep. 1976 p 447-454 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14118# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
FLUID DYNAMICS OF THE FLOATING ZONE
W. Wuest *In* ESA Mater. Sci. in Space Sep. 1976 p 454-465 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14119# Bristol Univ. (England). School of Chemistry.
CAPILLARY INSTABILITIES IN 1 g AND 0g
J. M. Haynes *In* ESA Mater. Sci. in Space Sep. 1976 p 467-471 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N77-14405 Clarkson Coll. of Technology, Potsdam, N.Y.
DIFFERENTIAL EBULLIOMETRY Ph.D. Thesis
Walace Alves DeOliveira 1975 174 p
Avail: Univ. Microfilms Order No. 76-18849

A twin thermistor ebullioscope is described. It works with Cottrell pumps to help achieve liquid-vapor equilibrium. Closely matched thermistors are used as the temperature sensing elements, and the properties of these thermistors at 100 C were measured and the apparatus sensitivity was calculated. The effects of the experimental variables that govern the proper functioning of the ebullioscope were investigated. Dissert. Abstr.

N77-14406* National Aeronautics and Space Administration. Pasadena Office, Calif.
MASS SPECTROMETER WITH MAGNETIC POLE PIECES PROVIDING THE MAGNETIC FIELDS FOR BOTH THE MAGNETIC SECTOR AND AN ION-TYPE VACUUM PUMP Patent
Leonard M. Sieradski (JPL), Charles E. Giffin (JPL), and Alfred O. Nier, inventors (to NASA) (JPL) Issued 7 Dec. 1976 8 p Filed 21 Nov. 1975 Supersedes N76-13456 (14 - 04, p 0453) Sponsored by NASA
(NASA-Case-NPO-13663-1; US-Patent-3,996,464; US-Patent-Appl-SN-634205; US-Patent-Class-250-289; US-Patent-Class-250-298) Avail: US Patent Office CSCL 14B

A mass spectrometer (MS) with unique magnetic pole pieces which provide a homogenous magnetic field across the gap of the MS magnetic sector as well as the magnetic field across an ion-type vacuum pump is disclosed. The pole pieces form the top and bottom sides of a housing. The housing is positioned so that portions of the pole pieces form part of the magnetic sector with the space between them defining the gap region of the magnetic sector, through which an ion beam passes. The pole pieces extend beyond the magnetic sector with the space between them being large enough to accommodate the electrical parts of an ion-type vacuum pump. The pole pieces which provide the magnetic field for the pump, together with the housing form the vacuum pump enclosure or housing.
Official Gazette of the U.S. Patent Office

N77-14407* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MINIATURE BIAXIAL STRAIN TRANSDUCER Patent
Ira S. Hoffman, inventor (to NASA) Issued 7 Dec. 1976 6 p Filed 30 Dec. 1975 Supersedes N76-16396 (14 - 07, p 0847)
(NASA-Case-LAR-11648-1; US-Patent-3,995,476; US-Patent-Appl-SN-645571; US-Patent-Class-73-133R) Avail: US Patent Office CSCL 14B

A reusable miniature strain transducer for use in the measurement of static or quasi-static, high level, biaxial strain on the surface of test specimens or structures was studied. Two cantilever arms, constructed by machining the material to appropriate flexibility, are self-aligning and constitute the transducing elements of the device. Used in conjunction with strain gages, the device enables testing beyond normal gage limits for high strains and number of load cycles. The device does not require conversion computations since the electrical output of the strain gages is directly proportional to the strain measured. Official Gazette of the U.S. Patent Office

N77-14408* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ELECTRON MICROSCOPE APERTURE SYSTEM Patent
Klaus Heinemann, inventor (to NASA) (NAS-NRC) Issued 7 Dec. 1976 6 p Filed 23 Jul. 1973 Supersedes N74-12191 (12 - 03, p 0293) Continuation-in-part of abandoned US Patent Appl. SN-221670, filed 28 Jan. 1972 Sponsored by NASA
(NASA-Case-ARC-10448-3; US-Patent-3,996,468; US-Patent-Appl-SN-318848; US-Patent-Class-250-396; US-Patent-Appl-SN-221670) Avail: US Patent Office CSCL 14B

An electron microscope including an electron source, a condenser lens having either a circular aperture for focusing a solid cone of electrons onto a specimen or an annular aperture for focusing a hollow cone of electrons onto the specimen, and

an objective lens having an annular objective aperture, for focusing electrons passing through the specimen onto an image plane are described. The invention also entails a method of making the annular objective aperture using electron imaging, electrolytic deposition and ion etching techniques.

Official Gazette of the U.S. Patent Office

N77-14409* National Aeronautics and Space Administration. Pasadena Office, Calif.

THERMOCOUPLE INSTALLATION Patent

Walter B. Powell (JPL), Lee R. Potter (JPL), and Kenton S. MacDavid, inventors (to NASA) (JPL) Issued 7 Dec. 1976 8 p Filed 22 Nov. 1974 Supersedes N75-12276 (13 - 03, p 0297) Sponsored by NASA

(NASA-Case-NPO-13540-1; US-Patent-3,996,070; US-Patent-Appl-SN-526450; US-Patent-Class-136-233; US-Patent-Class-136-232) Avail: US Patent Office CSCL 14B

A thermocouple assembly which includes a plug having a pair of small diameter holes near one end thereof which are spaced a small distance apart to leave a thin quantity of plug material between the holes is presented. There are a pair of thermocouple wires extending through the different holes and with the outer ends of the wires joined to the thin quantity of plug material which lies between the holes to form a thermocouple junction. Official Gazette of the U.S. Patent Office

N77-14410 British Library Lending Div., Boston Spa (England).

HALL EFFECT FLUXMETERS OF THE QUOTIENT SYSTEM TYPE FOR MEASURING CONSTANT MAGNETIC FIELDS

Z. L. Warsza and J. Galinski Oct. 1975 9 p refs Transl. into ENGLISH from Pomiary Autom. Kontrola (Warsaw), v. 20, no. 9, 1974 p 396-397

(BLL-DRIC-Trans-4267-(3623.66)) Avail: British Library Lending Div., Boston Spa, Engl.

The principle of the operation of, and the practical results obtained with, Hall effect fluxmeters with an original a.c. quotient measuring system is described. For the 0.1 mT range a measurement accuracy giving an error smaller than 0.5% was achieved with a stable reading on an external four digit digital voltmeter. Author

N77-14411* National Aeronautics and Space Administration. Pasadena Office, Calif.

METHOD AND APPARATUS FOR BACKGROUND SIGNAL REDUCTION IN OPTO-ACOUSTIC ABSORPTION MEASUREMENT Patent

Lars-Goeran Rosengren, inventor (to NASA) (JPL) Issued 7 Dec. 1976 5 p Filed 25 Jul. 1975 Supersedes N75-29383 (13 - 30, p 2520) Sponsored by NASA

(NASA-Case-NPO-13683-1; US-Patent-3,995,960; US-Patent-Appl-SN-599284; US-Patent-Class-356-204; US-Patent-Class-250-343; US-Patent-Class-356-97; US-Patent-Class-356-201) Avail: US Patent Office CSCL 14B

The sensitivity of an opto-acoustic absorption detector is increased to make it possible to measure trace amounts of constituent gases. A second beam radiation path is created through the sample cell identical to a first path except as to length, alternating the beam through the two paths and minimizing the detected pressure difference for the two paths while the beam wavelength is tuned away from the absorption lines of the sample. Then with the beam wavelength tuned to the absorption line of any constituent of interest, the pressure difference is a measure of trace amounts of the constituent. The same improved detector may also be used for measuring the absorption coefficient of known concentrations of absorbing gases.

Official Gazette of the U.S. Patent Office

N77-14412*# El-Sum Consultants, Atherton, Calif.

ANALYTICAL STUDY OF ACOUSTO/OPTICAL HOLOGRAPHY-INTERFACING METHODS FOR ACOUSTICAL AND OPTICAL HOLOGRAPHY NDT RESEARCH

H. M. A. EL-Sum Washington NASA Dec. 1976 96 p refs (Contract NAS8-31783)

(NASA-CR-2775; M-197) Avail: NTIS HC A05/MF A01 CSCL 14E

The international status of the art of acousto optical imaging techniques adaptable to nondestructive testing and, interfacing methods for acoustical and optical holography in nondestructive testing research are studied. Evaluation of 20 different techniques encompassed investigation of varieties of detectors and detection schemes, all of which are described and summarized. Related investigation is reported in an Appendix. Important remarks on image quality, factors to be considered in designing a particular system, and conclusions and recommendations are presented. Three bibliographies are included. Author

N77-14413*# Naval Electronics Lab. Center, San Diego, Calif. Infrared Devices Group.

CHARACTERIZATION OF IRAS DOPED SILICON DETECTORS

Dec. 1976 135 p refs

(NASA Order A-31473-B)

(NASA-CR-151941) Avail: NTIS HC A07/MF A01 CSCL 14B

Data are presented from a range of operating conditions which include background photo flux, operating temperature, and frequency. Each detector is equipped with a load resistor, a cryogenic field effect transistor preamplifier, and a temperature sensor. Data are also presented of detector signal, noise spectra, noise equivalent power, and spectral response. M.C.F.

N77-14414# California Univ., Berkeley. Lawrence Berkeley Lab.

CALIBRATION OF ENERGY DISPERSIVE X-RAY SPECTROMETERS FOR ANALYSIS OF THIN ENVIRONMENTAL SAMPLES

R. D. Giauque, R. B. Garrett, and L. Y. Goda 26 Jan. 1975 21 p refs Presented to the Symp. on X-ray Fluorescence Analysis of Environmental Samples, Chapel Hill, North Carolina, 26 Jan. 1976

(Contract W-7405-eng-48)

(LBL-4481; Conf-760125-1) Avail: NTIS HC A02/MF A01

Separate techniques for calibrating energy dispersive X-ray spectrometers are described. They include the use of (1) individual evaporated elemental thin-film standards, (2) nebulized multielement standard solution deposits to determine relative elemental sensitivity factors, (3) a semi-empirical approach to calculate relative elemental sensitivity factors, and (4) thick pure element disks. The first three techniques are applicable for a broad range of elements. The utilization of nebulized multielement standard solution deposits, along with an evaporated single element thin-film standard for absolute system calibration, is the most accurate method of the calibration techniques described. ERA

N77-14415# Carnegie-Mellon Univ., Pittsburgh, Pa.

MOESSBAUER BACKSCATTER SPECTROMETER WITH FULL DATA PROCESSING CAPABILITY Final Technical Report

1976 67 p refs Sponsored by ERDA

(COO-3033-1) Avail: NTIS HC A04/MF A01

The design and operation of a Moessbauer backscatter spectrometer with full data processing capability is described, and the investigation of the applicability of this technique to a variety of practical metallurgical problems is discussed.

Author (ERA)

N77-14416# ARO, Inc., Arnold Air Force Station, Tenn.

AN INVESTIGATION OF THE USE OF THE FABRY-PEROT INTERFEROMETER FOR FLOW FIELD DIAGNOSTICS USING RAMAN SCATTERING Final Report, 1 Jul. 1974 - 21 Jul. 1975

D. P. Weaver and J. W. L. Lewis AEDC Jun. 1976 40 p refs

(ARO Proj. V23S-37A; ARO Proj. V32S-06A)

(AD-A026471; ARO-VKF-TR-75-129; AEDC-TR-76-61) Avail: NTIS HC A03/MF A01 CSCL 14/2

A new interferometric technique for the detection of rotational Raman scattering was demonstrated. The technique involves the use of a Fabry-Perot interferometer to simultaneously pass all of the rotational lines from a single molecular specie while at the same time rejecting interfering light from other molecular species and that of Rayleigh scattered light. Data were obtained for total ground state rotational Raman scattering intensity versus interferometer plate separation. Calculations are presented which

predict the rotational temperature dependence of the transmitted intensity of the Fabry-Perot interferometer. The use of the technique for both rotational and vibrational temperature measurements as well as determination of molecular number density is discussed. The results of this study indicate that a significant increase in sensitivity for a Raman scattering measurement of both density and temperature can be obtained using Fabry-Perot interferometry. Additionally, it was found that, for a wide temperature range, the N2 density measurement can potentially be made without knowledge of the gas temperature. GRA

N77-14417# Edgerton, Germeshausen and Grier, Inc., Albuquerque, N.Mex.
MGL-S8(R) B-DOT SENSOR DEVELOPMENT Final Report
Stewart L. Olsen Apr. 1976 52 p refs
(Contract F29601-75-C-0085; AF Proj. 1209)
(AD-A025367; AFWL-TR-75-252) Avail: NTIS HC A04/MF A01 CSCL 18/3

This report describes the development of an extremely small, Multi-Gap Loop B-Dot Sensor. The sensor is a half cylinder loop on a ground plane (A sub eg = 0.00001/sq. m) and produces a voltage output in response to a time variant B-field. The MGL-S8A(R) has an improved gap and transmission line geometry to place the old MGL series design. The theory of operation, design and construction, modeling experiments, prototype testing and test results are discussed within. Author (GRA)

N77-14418# Science Applications, Inc., Atlanta, Ga.
DIGITAL PHOTON CORRELATION DATA PROCESSING TECHNIQUES Final Report, 3 May 1974 - 31 Oct. 1975
W. T. Mayo, Jr. Jul. 1976 134 p refs
(Contract F40600-74-C-0016)
(AD-A027195; AEDC-TR-76-81) Avail: NTIS HC A07/MF A01 CSCL 14/2

Presently available laser velocimeter (LV) electronic signal processing techniques are often inadequate for detection of light scattered by small scattering particles which are required for following the fluid motions. Example situations include low pressure and/or high velocity measurements. In other situations detection of larger scattering particles is difficult due to limited system sensitivity. Photon counting techniques offer improved system sensitivity by allowing velocity measurements to be made even when there are insufficient signal photons available to define the classical scattering signal. Such techniques are thus applicable when the presently used classical techniques are not. The objective of this contract was the theoretical and experimental development of a new type of photon-counting processor for low-level dual-scatter LV signal detection. The contract was conducted in three separately funded phases: the first was a mathematical feasibility and preliminary hardware design study for a photon-counting processor; the second was a more detailed study of the statistical nature of low-level LV signals and their effects on low-level signal processing; and the third phase was the detailed design, construction, and demonstration of a new photon counting signal processor for photon resolved laser velocimeter signals. The effort under this contract has resulted in several significant conclusions both theoretical and experimental. Author (GRA)

N77-14419# Environmental Research Inst. of Michigan, Ann Arbor.
OPTIMUM DISCRIMINATION USING HIGH GAMMA AERIAL COLOR PHOTOGRAPHY BY EXPOSURE CONTROL
G. Suits 21 May 1976 15 p
(AD-A027219) Avail: NTIS HC A02/MF A01 CSCL 14/5

An important application of aerial photography in remote sensing is the detection and discrimination of small changes in the spectral quality of objects or regions of interest from the spectral quality of the normal background. In particular, diseased areas of agricultural crops and forests, small stands of different species in forests, and water pollution all tend to exhibit small spectral variations indicative of the presence of important objects or conditions of interest. However, normally exposed, high gamma color photography frequently fails to record these conditions in an optimum fashion. In the following paragraphs, a systematic method of optimizing the discrimination by aerial photography is developed. Simple and cogent rules of thumb are derived for exposure control of high gamma color aerial photography for optimizing the discrimination of certain classes of background materials from target areas whose spectral properties are very close to those of the background. The logic for deriving the optimization procedure by exposure control makes use of the concepts of exposure magnitude and direction of color film. These two new concepts are described below. Author (GRA)

N77-14420# Accumetrics Corp., Cambridge, Mass.
PIEZOELECTRIC FALLING-SPHERE ACCELEROMETER SYSTEMS FOR MEASURING HIGH ALTITUDE ATMOSPHERIC DENSITY Final Report, Jan. 1973 - Dec. 1975
Donald H. Fryklund Mar. 1976 44 p
(Contract F19628-73-C-0112; AF Proj. 6689)
(AD-A026513; AC-215; AFGL-TR-76-0064) Avail: NTIS HC A03/MF A01 CSCL 04/1

Falling-sphere atmospheric density measuring systems were developed using piezoelectric accelerometers. Seven-inch and ten-inch diameter spheres were developed, fabricated and tested. A new accelerometer was designed for the seven-inch system. An improved design of the accelerometer developed under Contract F19628-71-C-0131 was integrated into the ten-inch system. Author (GRA)

N77-14421# Army Engineer Topographic Labs., Fort Belvoir, Va.
HOLOGRAPHIC RAY TRACING AND SPOT DIAGRAMS
Eugene A. Margerum Aug. 1975 128 p refs
(DA Proj. 4A1-6101-A-01D)
(AD-A027043; ETL-0052) Avail: NTIS MF A01 CSCL 20/6

A method is developed for computing spot diagrams of holographic images of point objects. The hologram is treated as an array of approximating gratings, and the spot diagrams are obtained by extending the emergent rays to planes in the region of the Gaussian image. Computed spot diagrams are given for one set of formation parameters where the reconstruction parameters have been varied to show the effects of slight to severe changes in reconstruction conditions. The parameters changed include variations x, y, and z coordinates of the reconstruction (reference) source and wavelength. Derivation of the new equations is given, and also a copy of a sample computer program is included. The spot diagrams were made using an automatic computer plotter. Author (GRA)

N77-14422# Army Electronics Command, Fort Monmouth, N.J.
PHOTORESPONSIVE RETINA (THE CHEMICAL DEPOSITION OF PbSe) Final Report, Sep. 1971 - Jun. 1973
Phillip R. Boyd, Arlin J. Brown, and Wolfgang Elser Feb. 1976 37 p
(DA Proj. 1T1-61102-31B)
(AD-A026958; ECOM-7053) Avail: NTIS HC A03/MF A01 CSCL 20/6

The object of this program was to research economical methods for the preparation of high-performance lead selenide layers by chemical deposition from aqueous solutions and to demonstrate the feasibility of their fabrication into multi-element arrays for use in thermal night vision systems. Prior to this work, a fully detailed sequence of process steps for the deposition and fabrication of lead selenide devices had been published in only a few instances. Regrettably, in most of these cases, the performance characteristics of the obtained layers were not presented. It was felt that an investigation of the chemical deposition process for lead selenide and a detailed report of the results including all process steps and subsequent electrical and optical characteristics were necessary to stimulate additional research in this area and reduce the cost of these systems. The results of this investigation indicate that high-quality lead selenide layers, which can be fabricated into high-performance devices, can be obtained by a relatively economical process. GRA

N77-14423# Block Engineering, Inc., Cambridge, Mass.
CRYOGENIC EMITTANCE SPECTROMETER Final Technical Report, May 1973 - Apr. 1975
Paul G. Morse and James R. Engel Apr. 1976 40 p refs
(Contract F19628-73-C-0265; ARPA Order 2243)
(AD-A026203; RADC-TR-76-126) Avail: NTIS HC A03/MF A01 CSCL 20/6

The design and fabrication of a high sensitivity cryogenic emittance Fourier interferometer system for measuring the infrared emission of low absorptance samples is described. The spectrometer, cooled to LN2 temperature has a maximum spectral resolution of 0.5 per cm in the 2.5 - .14 micrometer range and a noise equivalent emissivity limit of better than 0.000005 at 10 micrometer. In addition to the spectrometer the system includes a data processing system for the reduction and storage of the spectral data. The emissometer system has been tested and meets all specifications. Data obtained during the acceptance test phase of the program is presented in this report.
Author (GRA)

N77-14424# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
A SATELLITE-CONTROLLED DIGITAL CLOCK Final Report
J. V. Cateora and D. D. Davis Jun. 1976 49 p refs
(PB-257162/8; NBS-TN-681) Avail: NTIS HC A03/MF A01 CSCL 17B

A digital clock, resettable and controlled by the time code relayed by NOAA's SMS/GOE Satellites, is discussed. The clock's design is based upon a four bit microprocessor and uses the redundancy of the data to improve its performance. Satellite position is included in the clock's display for delay corrections to the received time. A discussion of the generation, distribution, and reception of the time code is also included to aid the explanation of the clock's operation and performance. GRA

N77-14425# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
DEVELOPMENT OF THE BRINELL SANDWICH PASSIVE TRANSDUCER
Andres Peekna 1976 14 p refs
(AD-A026143) Avail: NTIS HC A02/MF A01 CSCL 08/13

Passive stress gages can provide a cost-effective method of measuring peak stress in soil and on a soil-structure interface. Ideally, the deformation characteristics of a soil stress gage should match the soil as closely as possible. However, a flat, disc-shaped gage whose stiffness is greater than that of the soil is not very sensitive to variations in soil properties. Since pretest predictions of peak stress resulting from nuclear and high-explosive detonations are often very inaccurate, the widest possible sensing range is clearly advantageous. For maximum usefulness when dealing with pulses of different rise times and durations, the gage should be free of rate effects over as broad a range of pulse shapes as possible. Author (GRA)

N77-14426# Naval Civil Engineering Lab., Port Hueneme, Calif.
EXPENDABLE DOPPLER PENETROMETER Interim Report, Dec. 1973 - Apr. 1975
R. M. Beard Apr. 1976 28 p refs
(yf52556999)
(AD-A026107; CEL-TN-1435) Avail: NTIS HC A03/MF A01 CSCL 08/10

An expendable penetrometer using the Doppler principle has been developed to expediently test seafloor soils at water depths to 20,000 feet. The velocity of the penetrometer is measured as it penetrates seafloor soils; from the velocity record, soil penetrability and an estimate of soil strength are available. The penetrometer weighs 365 pounds, is 10 feet long, is 3-1/2 inches in diameter, and is easily deployed from a ship. Initial testing indicates that the concept of a Doppler instrumentation system is workable, that penetration can be accurately determined, and that deceleration can be ascertained. The penetrometer reaches a terminal velocity of about 80 feet per second which, based on penetration theory, is sufficient to obtain about 30 feet of penetration in a pelagic clay. It is anticipated that with experience the penetrometer in many cases can be used by itself to design direct-embedment anchorages, thereby eliminating the need for cores and geophysical measurements for this purpose. For other cases, the penetrometer will supplement soil coring and geophysical measurements for anchorage and foundation design. Author (GRA)

N77-14427# Science Applications, Inc., Albuquerque, N. Mex.
BASICS OF GROUND MOTION INSTRUMENTATION Final Report
Reynold A. Shunk 31 Aug. 1975 40 p refs
(Contract DNA001-74-C-0245; DNA Proj. NWET-AAXSX352) (AD-A026751; SAI-75-501-AQ; DNA-3712F) Avail: NTIS HC A03/MF A01 CSCL 19/4

This document is designed as a brief introduction into the ground motion measurements field by describing a general measurement system, presenting examples of transducer operating principles and internal configuration, and identifying current problem areas in ground motion measurements. GRA

N77-14092# Freiburg Univ. (West Germany). Inst. fuer Kristallographie.
A RADIATION FURNACE FOR ZONE-CRYSTALLISATION EXPERIMENTS IN SPACE
A. Eyer, H. Zimmermann, and R. Nitsche *In* ESA Mater. Sci. in Space Sep. 1976 p 241-244 Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14108# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
UNIDIRECTIONAL SOLIDIFICATION APPARATUS FOR SOUNDING ROCKETS
L. R. McCreight, M. J. Noone, and R. J. Locker *In* ESA Mater. Sci. in Space Sep. 1976 p 365-368 (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N77-14428 Princeton Univ., N.J.
CARBON MONOXIDE VIBRATIONAL KINETICS IN A TRANSVERSE ELECTRIC DISCHARGE WAVEGUIDE LASER Ph.D. Thesis
Jean-Luc Gabriel Boulnois 1975 221 p
Avail: Univ. Microfilms Order No. 76-23799

A model is presented for the molecular kinetics of a CO Electric Discharge Laser. The model is based on a set of vibrational rate equations including excitation by electron impacts, single quantum vibration-vibration (V-V) exchange collisions, single quantum vibration-translation (V-T) energy transfer collisions and spontaneous emission of radiation. The electron-molecule coupling resulting in vibrational excitation involves the entire vibrational manifold through a multilevel pumping scheme. Vibrational population distributions are characterized by the ratio between a characteristic time for the exchange of vibrational quanta and a characteristic pumping time. In a steady state analysis the model describes the coupling between subsonic one-dimensional channel flow and vibrational kinetics in a Transverse Electric Discharge Waveguide configuration. Conversion of electrical energy into vibrational energy is shown to be feasible with good efficiency. Dissert. Abstr.

N77-14429*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE SUPERCONDUCTING CAVITY-STABILIZED MASER OSCILLATOR
W. H. Higa 15 Dec. 1976 22 p refs
(Contract NAS7-100)
(NASA-CR-149278; JPL-TM-33-805) Avail: NTIS HC A02/MF A01 CSCL 20E

The possibility of integrating a superconducting cavity with a traveling wave maser is explored to obtain a frequency standard with very high spectral purity. Author

N77-14430# Lockheed Missiles and Space Co., Palo Alto, Calif.
THRESHOLD PHENOMENA IN LASER CHEMICAL REACTIONS
V. V. Gorlevskii, A. N. Oraevskii, A. V. Pankratov, A. N. Skachkov, and V. M. Shabarshin 1975 4 p refs Transl. into ENGLISH from Khim. Vysokikh Energii (USSR), v. 10, no. 5, 1975 p 443-446
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Threshold phenomena are investigated in strongly exothermal

laser chemical reactions of hydrazine tetrafluoride and in laser chemical, almost thermally neutral, reactions of monosilane decomposition. Functional dependencies of the threshold quantities are determined. The acute sharpness of the threshold boundary is shown. A qualitative treatment of the phenomena is given. Author

N77-14431# Lockheed Missiles and Space Co., Palo Alto, Calif.
INITIATION OF EXOTHERMAL REACTIONS BETWEEN BORON AND TITANIUM AND BORON AND ZIRCONIUM BY A LASER LIGHT PULSE
G. V. Khil'chenko, I. I. Korotkevich, L. M. Vidavskii, G. P. Polunina, and E. A. Ippolitova 1976 5 p refs Transl. into ENGLISH from Vestnik (Moscow), no. 3, 1976 p 341-345
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The formation reactions of titanium and zirconium diborides from simple materials by means of kinetic characteristics are among the gasless reaction categories. Initiation of these reactions was accomplished by an inflammable mixture and electric heater, and by light energy flux from a xenon lamp. Light radiation from a laser was also used. Different gasless combustion reactions were initiated by lasers in order to determine the minimum values of the ignition energy as a function of the particle size of the constituents and of the initial temperature. Author

N77-14432# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON ELECTRON BEAM INITIATION OF A HYDROGEN FLUORIDE LASER
V. I. Igoshin, V. Iu. Nikitin, and A. N. Oraevskii 1976 3 p refs Transl. into ENGLISH from Kvanto. Elektron. (USSR), v. 3, no. 9, 1976 p 2072-2074
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The effect of beam current density on the chemical efficiency of a laser using a hydrogen and fluorine mixture is investigated. The possibility of reducing the current density of the initiating beam while retaining high values of chemical and technical efficiency is explored. Author

N77-14433# Lockheed Missiles and Space Co., Palo Alto, Calif.
RECOIL PULSES ON METAL TARGETS SUBJECTED TO MICROSECOND CO2-LASER RADIATION
I. Apostol, V. A. Batanov, I. N. Mikheilesku, I. Morzhan, A. M. Prokhorov, and V. B. Fedorov 3 Feb. 1976 4 p refs Transl. into ENGLISH from Kvantov. Elektr. (USSR), vol. 3, no. 9, 1976 p 2054-2056
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The stationary plane development of metal evaporation is investigated by a pulsed carbon dioxide laser beam at lambda = 10.6 micron radiation wavelength. Single crystals of pure bismuth, aluminum, lead, and zinc are used as target surfaces. A crater is formed in the zone of target irradiation, whose depth characterizes the loss of materials mass from the target as a result of radiation. The efflux of the substance ionized by the incident radiation from the crater produces a reactive pressure on the target during the pulse effect. Measurement of the vapor recoil and the lost mass permits assessment of the processes at the target. Author

N77-14434# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE GASDYNAMIC PROCESSES AND RECOIL PULSE DURING OPTICAL BREAKDOWN OF THE AIR NEAR A TARGET SURFACE SUBJECTED TO THE RADIATION OF AN ELECTRON-IONIZED CO2-LASER
V. A. Boiko, V. A. Canilychev, V. D. Zvorykin, I. V. Kholin, and A. Iu. Chugunov 2 Feb. 1976 7 p refs Transl. into ENGLISH from Kvantov. Elektr. (USSR), vol. 3, no. 9, 1976 p 1955-1961
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Gasdynamic processes associated with the effect of 10 to the 9th power W electron-ionized carbon dioxide laser radiation on a metal target are investigated. The large optical breakdown area (up to 27 sq cm) developed near the target surface, and the short duration of the laser pulse permit realization of an almost one dimensional gasdynamic motion mode. It is shown that the development of a plasma torch under these conditions is described by the model of a strong plane explosion. A reduction in the air breakdown threshold under the effect of the plasma torch radiation is detected. A difference in the propagation velocity of the laser radiation absorption wave from the theoretical dependence for a light detonation wave is observed. The ratio between the recoil pulse and the energy is measured as 12.6 dyne/sec/J. The possibility is shown of achieving high values of the recoil pulse for large sizes of the focusing point. Author

N77-14435# Lockheed Missiles and Space Co., Palo Alto, Calif.
PARAMETRIC ANALYSIS OF A PULSED H2-F2 LASER
V. Ia. Agroskin, G. K. Vasilev, V. I. Kirianov, and V. L. Talroze 1976 9 p refs Transl. into ENGLISH from Kvantovaia Elektron. (USSR), v. 3, no. 9, 1976 p 1932-1940
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

A parametric model of a pulsed chemical H2-F2 laser is proposed which permits computation of the laser generation energy as a function of initial conditions. The experimental results obtained agree satisfactorily with results of a computation. The mutual position of the thresholds of a photo-initiated explosion and of laser generation is analyzed as a function of the relationship between the initiating pulse duration and the characteristic relaxation time. A qualitative comprehension of the relative roles of the chemical and relaxational processes in the generation energetics is obtained. Author

N77-14436# Los Alamos Scientific Lab., N.Mex.
LASER-FUSION TARGET FABRICATION: APPLICATION OF ORGANIC COATINGS TO METALLIC AND NONMETALLIC MICROPELLETS BY THE GLOW-DISCHARGE POLYMERIZATION OF P-XYLENE
G. A. Simonsic Jan. 1976 5 p refs
(Contract W-7405-eng-36)
(LA-6207) Avail: NTIS HC A02/MF A01

Laser fusion targets require thin, uniform organic film coatings. A coating technique involving glow discharge polymerization is described for applying highly adherent, extremely uniform, thin films of a high temperature polymer to a variety of microsubstrates. Polymeric coatings have been successfully deposited on hollow, spherical, micropellets of glass, metal-coated glass, and nickel/manganese alloy. Experimental yields of coatings of a quality acceptable for laser fusion targets are typically greater than 90 percent. ERA

N77-14437# Pittsburgh Univ., Pa. Atomic Sciences Inst.
ATOMIC AND MOLECULAR PROCESSES Progress Report No. 20
1976 14 p
(Contract N00014-76-C-0098; ARPA Order 2686)
(AD-A025369) Avail: NTIS HC A02/MF A01 CSCL 20/5

Contents: Laser Studies; Atmospheric Radiation Backgrounds; and Infrared Chemiluminescence and Early Warning. GRA

N77-14438# Stanford Research Inst., Menlo Park, Calif.
NEW ELECTRONIC-TRANSITION LASER SYSTEMS. PART 1: ELECTRON PUMPED SYSTEMS Midterm Technical Report No. 4A, 8 Feb. 1975 - 15 Apr. 1976
M. V. McCusker, D. C. Lorents, D. L. Huestis, R. M. Hill, and H. H. Nakano May 1976 73 p refs
(Contract DAAH01-74-C-0524; ARPA Order 1180; SRI Proj. PYU-3190)
(AD-A027128; SU-SRI-MP-76-46-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 20/5

Considerable progress in understanding the kinetic processes involved in electron-pumped rare gas-halogen mixtures, particularly Ar/I2, is reported. This gas system has great promise as a scalable, high-power laser medium capable of being pumped by electron beam, e-beam-sustained discharge, or nuclear fission fragments. The kinetic model involves the production of excited rare gas, followed by two very fast neutral energy transfer steps. The selective energy flow is simply represented as Ar^* to I^* to $I2^*$ followed by collisional relaxation of the $I2^*$ to a single state radiating the 342.5 nm band with high fluorescence yield. Extensive experimental measurements were made testing this model and measuring the relevant rate coefficients and cross-

sections. Kinetic steps involving halogen ions cannot be completely ruled out, but the results given here argue against their importance. Sustained discharge pumping is discussed briefly and a projected overall efficiency of approximately 20% is predicted.
Author (GRA)

N77-14439# Stanford Research Inst., Menlo Park, Calif.
NEW ELECTRONIC-TRANSITION LASER SYSTEMS. PART 2: CHEMICALLY PUMPED SYSTEMS Midterm Technical Report No. 4B, 8 Aug. 1975 - 15 Apr. 1976
D. J. Eckstrom, S. G. Prakash, B. E. Perry, and S. W. Benson May 1976 55 p refs
(Contract DAAH01-74-C-0524; ARPA Order 1180; SRI Proj. PYU-3190)
(AD-A027129; SU-SRI-MP-76-47-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 20/5

Experimental and analytical studies aimed at development of visible chemical lasers are reported. During this period intracavity dye laser measurements of a Ba + N2O flame revealed absorption on several BaO transitions and indicated large concentrations of Ba and Ba(+) metastables. Additional measurements on Ba + N2O in a heat-pipe-oven reactor confirmed the dominant role of metal atom density on BaO photon yield, and showed that current kinetic models are inadequate. Imposition of microwave and dc electric fields on a Ba + N2O flame decreased BaO emission, thus reducing hopes for a hybrid discharge-chemical laser. A shock tube program was initiated to study premixed, pulsed reactions of volatile encapsulated metals with oxidizers. So far, we have examined Ni(CO)4 with N2O and NF3 and Sn(CH3)4 with N2O. Molecular emission from these reactions was much weaker than anticipated. In particular, we observed only SnO(D-X) bands rather than the a-X and A-X bands expected on the basis of flame studies. An analysis of the excited molecular state production expected from atom association reactions in a shock tube-expansion nozzle environment indicates that the maximum gain expected is less than 10 to the minus 6th power per cm. Thus, this does not appear to be a feasible approach to development of visible chemical lasers.
Author (GRA)

N77-14440 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ROLE OF NONEQUILIBRIA IN LASER SUPPORTED COMBUSTION WAVES IN NITROGEN Ph.D. Thesis
James H. Havey, Jr. Jul. 1976 238 p refs
(AF Proj. 9994)
(AD-A027505; DS/PH/76-1) Avail: NTIS MF A01 CSCL 07/5

The role of nonequilibrium phenomena in the propagation of Laser Supported Combustion waves in nitrogen was examined from a variety of viewpoints. Graphical techniques and criteria were developed and applied over a wide range of laser power levels to assess the role and importance of possible non-Maxwellian electron energy distributions and electron thermal nonequilibrium with the heavy species for Maxwellian electron distributions. In the LSC wave power regime it was found that the electron energy distributions were essentially Maxwellian and that electron thermal nonequilibrium did not significantly affect wave propagation characteristics. Nitrogen spectroscopy was discussed, and particular features of nitrogen emission and absorption of radiation were identified as being important to radiative ionization processes and the general radiation transport problem. Chemical and ionic reactions involving atomic and molecular nitrogen and their ions were discussed, and the important reactions and their associated rates were identified. Finally, a simple, one-dimensional hydrodynamic computer code incorporating thermal radiation transport, laser absorption processes and chemical and ionic reactions was applied to two examples (at 100,000 and 1,000,000 watts/sq cm). Calculations showed that although there was substantial chemical and ionic nonequilibrium in the ionization breakdown region, these nonequilibria had a negligible effect on the propagation characteristics predicted by the equilibrium model.
Author (GRA)

N77-14441# RAND Corp., Santa Monica, Calif.
THE TECHNOLOGY OF PRECISION GUIDANCE--CHANGING WEAPON PRIORITIES, NEW RISKS, NEW OPPORTUNITIES
James Digby Nov. 1975 31 p refs
(AD-A026653; P-5537) Avail: NTIS HC A03/MF A01 CSCL 17/7

For centuries most of the things shot by military men at their enemies have missed their target. The remarkable thing about the new generation is that it is now possible for forces to possess weapons in large numbers each of which has a high probability of hitting its target with a single shot. This article discusses the implications of these weapons, which are officially called precision-guided munitions or PGMs. Usually, this simply means a bomb or missile that is guided in its terminal phase. Thus, the term includes many anti-tank weapons (including some which receive steering signals over thin wires) and air-defense missiles, as well as the laser-guided bombs which attracted so much public attention.
GRA

N77-14442# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Ground Equipment/Materials Directorate.
DESCRIPTION AND OPERATION OF THE LABORATORY LASER COOLING MODULE (LCM) FOR THE MOBILE TEST UNIT (MTU)
Dean C. Reese 27 May 1976 24 p ref
(DA Proj. 1X3-63314-D-093)
(AD-A027057; RL-76-20) Avail: NTIS HC A02/MF A01 CSCL 20/5

This report briefly explains the design and operation of the Laser Cooling Module (LCM), a support module for the Mobile Test Unit (MTU). Prior to, during and after the lasing operation of the MTU, varying quantities of heat are generated by the laser. This heat must be removed at the laser and expelled elsewhere for proper operation. The purpose of the LCM is just that: to remove laser heat and expel it to the atmosphere. The proper functioning of the LCM has a direct relationship to the MTU laser power output.
Author (GRA)

N77-14443# Illinois Univ., Urbana-Champaign. Electro-Physics Lab.
ELECTRON-BEAM CONTROLLED GAS LASERS Final Report, 1 Apr. 1974 - 31 Mar. 1976
Thomas A. DeTemple Mar. 1976 50 p
(Contract NSF GK-42104)
(PB-256695/8; UILU-ENG-75-2544) Avail: NTIS HC A03/MF A01 CSCL 20E

The use of electron beams to initiate electrical discharges in high pressure gas lasers was explored specifically as a technique for obtaining improved laser performance. Laser action was achieved on electronic transitions in Ar, He, Xe, and Cl and on vibrational-rotational transitions in CO2. Of particular significance was the observation that the neutral Xe transitions near 2 micrometers lased at an order of magnitude higher power and efficiency than had previously been observed. In addition, multi-kilowatt outputs were obtained in the near-infrared from N2 and Ar suggesting that enhanced laser action may be obtained from many previously known lasers at higher gas pressures.
GRA

N77-14444# Columbia Univ., New York.
POLARIZATION OF LASER-EXCITED FLUORESCENT LINES FROM 85Rb2 AND 87Rb MOLECULES
A. C. Tam and W. Happer 19 Jan. 1976 3 p refs Repr. from J. Chem. Phys., v. 64, no. 11, 1 Jun. 1976 p 4337-4339 Submitted for publication
(Contract DAAB07-74-C-0341; Grant AF-AFOSR-2685-74)
(AD-A026503) Avail: NTIS HC A02/MF A01 CSCL 07/4

Polarization studies are made of the various fluorescent lines from the excited 85Rb2(C) state or the 87Rb2(C) state populated by the 4765 or the 4880 A Ar ion laser lines. We conclude that the previous hypothesis that all these fluorescent lines are Q branches is incorrect.
Author (GRA)

N77-14445# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
SPECTROSCOPY OF FISSION FRAGMENT EXCITED ATMOSPHERIC PRESSURE ARGON AND XENON PLASMAS Ph.D. Thesis
Robert N. Davie, Jr. 1975 313 p refs
(AD-A026263; AFIT-CI-76-34) Avail: NTIS HC A14/MF A01 CSCL 20/9

Results of a spectroscopic investigation of atmospheric pressure Ar and Xe excited by fission fragments are reported. Spectra were taken at various distances from a planar fission fragment source, and a combined analytical and experimental absolute system calibration permitted estimation of excited state densities. The study was undertaken as part of an effort to develop new nuclear pumped laser systems, for which Ar and Xe are candidates. GRA

N77-14446# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
WATER VAPOR ABSORPTION MEASUREMENTS USING A LINE TUNABLE DEUTERIUM FLUORIDE LASER
Kenneth O. White, Wendell R. Watkins, and Charles W. Bruce 1976 15 p refs
(AD-A026165) Avail: NTIS HC A02/MF A01 CSCL 04/1

The design and performance of Army electro-optical systems depend on accurate and detailed knowledge of the atmospheric transmission in the 3-5 micrometers spectral region. This study concerns DF laser propagation (3.5-4.1 micrometers). The results of this work have important implications for laser as well as broadband infrared systems operating in the 3-5 micrometer atmospheric window. Systems which fall into this class are DF high-energy lasers, low-power lasers for target designation, infrared seekers, and infrared imaging scanners. The two primary sources of atmospheric attenuation of DF laser wavelengths are molecular absorption and aerosol attenuation (both scattering and absorption). For most meteorological conditions in which haze or fog are not present, molecular absorption is significantly greater than aerosol attenuation. For high-energy laser (HEL) system modeling, the molecular absorption contribution is particularly important because the energy absorbed quickly heats the atmosphere along the laser path, resulting in density variations and causing distortion (or thermal blooming) of the laser beam. Aerosol attenuation is less important for thermal blooming because the majority of aerosol attenuation results from scattering of energy out of the beam where it cannot cause blooming. GRA

N77-14447# ILC Technology, Inc., Sunnyvale, Calif.
PRODUCTION ENGINEERING MEASURE FOR OPTICAL PUMPS FOR LASERS Final Engineering Report, Jun. 1973 - Aug. 1975
Robert Maynard 15 Jul. 1976 113 p refs
(Contract DAAB05-73-C-2078)
(AD-A027212; R-ILC-73-22/F) Avail: NTIS HC A06/MF A01 CSCL 20/5

This program was directed toward establishing a capability for manufacturing fluid cooled and compressed gas cooled flashlamps to be used as optical pumps for Nd:YAG laser systems. Work on fluid cooled flashlamps was terminated early in the program. Flashlamps were designed, fabricated, and tested for specific electrical and optical characteristics using government-furnished specifications as a guideline. Gas cooled flashlamps constructed with 1.0 mm thick walls of synthetic fused quartz and filled with 450 torr of xenon were deemed most likely to meet the lifetime, triggering, and optical output requirements of the government-furnished specifications. Correlation was demonstrated between direct laser output measurements and the output of a fluorescent monitoring instrument. Automated digital test equipment was implemented for measuring and calculating flashlamp parameters. GRA

N77-14448# Martin Marietta Aerospace, Orlando, Fla. Electro-Optics Dept.
HIGH POWER INFRARED MODULATION Final Technical Report, 20 Nov. 1974 - 20 Nov. 1975
Ronald R. Selleck Jun. 1976 38 p refs
(Contract F33615-75-C-1018; AF Proj. 2001)
(AD-A027135; OR-14186; AFAL-TR-76-32) Avail: NTIS HC A03/MF A01 CSCL 20/6

This report describes an amplitude modulator designed to operate in conjunction with a CW carbon monoxide laser as it was developed and tested under contract No. F33615-75-C-1018, entitled 'High Power Infrared Modulator'. Although specific modulation requirements were stated for this effort, the approach selected was to have the potential for extended capabilities. The mechanism chosen to provide the modulation at the 5 micron wavelength region was the FTIR (Frustrated Total Internal Reflection) principle. By placing two BaF2 (Barium Floride) prisms in close proximity to each other and varying their spacing with the aid of piezo-electric transducers, modulation of the throughput was achieved. The device has a clear aperture of 2 centimeters and can handle an input laser beam in excess of 250 watts. The modulation produces a nominally square wave pulsed output with a rise and fall times of less than .5 milliseconds. A completely codeable system, its pulsed output can be varied in frequency and duty cycle from less than 100 Hertz to greater than 150 Hertz while maintaining a variable duty cycle capability from less than 20 percent to greater than 80 percent. The extinction ratio is better than 50:1 with greater than 85 percent total switching efficiency. This allows for an average throughput of greater than 100 watts at a 50 percent duty setting. GRA

N77-14449# Naval Postgraduate School, Monterey, Calif.
TRANSONIC THERMAL BLOOMING Ph.D. Thesis
Edwin Fenton Carey, Jr. Mar. 1976 21 p refs
(AD-A026456) Avail: NTIS HC A02/MF A01 CSCL 20/6

According to the linearized solutions for thermal blooming, the density perturbations become infinite (i.e.' 'catastrophic' defocusing) as the Mach number approaches unity. However, the nonlinearities in the transonic equations cutoff the trend to infinity, and the values of the flow perturbation quantities are finite. The nonlinear equations with heat addition are transformed into simple linear algebraic equations through the specification of the streamline geometry in the heat release region. At a Mach number of unity, streamtube area variation was found to be directly proportional to the change in total temperature. A steady, two-dimensional mixed flow solution has been found for the transonic thermal blooming problem. The solution for the density perturbations within a laser beam at a Mach number of precisely unity is given. GRA

N77-14450# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Ground Equipment/Materials Directorate.
DESCRIPTION AND OPERATION OF THE LABORATORY MIRROR TEMPERATURE REGULATING MODULE (MTRM) FOR THE MOBILE TEST UNIT (MTU)
Dean C. Reese 27 May 1976 27 p
(DA Proj. 1X3-63314-D-093)
(AD-A027070; RL-76-21) Avail: NTIS HC A03/MF A01 CSCL 20/6

This report briefly explains the design and operation of the Mirror Temperature Regulating Module (MTRM) for the Mobile Test Unit (MTU). The MTU laser cavity has three mirrors that direct the laser beam through an aerodynamic window into a beam expander impinging on a secondary mirror. The beam is directed out of the expander through a beam director and onto a designated target. During lasing, these four mirrors must be maintained at a relatively constant temperature by flowing conditioned water through each mirror. The MTRM, along its controller, maintains mirror water temperature at a relatively constant value regardless of ambient temperature. Author (GRA)

N77-14451# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INVESTIGATION OF TERBIUM IN THE FERROELECTRIC CRYSTAL, GADOLINIUM MOLYBDATE, AS A POTENTIAL LASER M.S. Thesis
Jackie E. Crouch Jun. 1976 75 p refs
(AD-A026008; GEO/PH/76-4) Avail: NTIS HC A04/MF A01 CSCL 20/6

A preliminary non-stimulated study of the laser host combination Gd(2 - x)Tb(x)(MoO4)3 is made. The host material, gadolinium molybdate (GMO), is a ferroelectric/ferroelastic crystal. An investigation of temperature and external electric field effects on the absorption and fluorescence of the crystal did not produce any unusual results. The terbium ion, Tb(3-), peak cross section in GMO for the 5D sub 4 to 7F sub 5 transition is 10 x 10 to the minus twenty first power sq. cm. at 300K. The wavelength of this four level laser transition is 543 nm. GRA

N77-14452# California Univ., Berkeley. Electronics Research Lab.
PICOSECOND PULSE GENERATION IN SYNCHRONOUSLY

PUMPED DYE LASERS
Z. A. Yasa and O. Teschke 16 Jun. 1975 5 p refs Repr. from Jul. of Optics Commun., v. 15, no. 2, Oct. 1975 p 169-172 Submitted for publication
(Contract F44620-71-C-0087; Grant NSF GK-37048X; AF Proj. 4751)
(AD-A027510; AFOSR-76-0498TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

Synchronously pumped dye lasers are studied. The ultrashort pulse evolution is numerically investigated for a large number of round-trips. A stationary pulse is found. Author (GRA)

N77-14453# Arizona Univ., Tucson. Optical Sciences Center.
APPLIED OPTICS RESEARCH Quarterly Report, 1 Jan. - 31 Mar. 1976
1 Apr. 1976 51 p refs
(Contract F04701-75-C-0248)
(AD-A027356; SAMSO-TR-76-112; QR-3) Avail: NTIS HC A04/MF A01 CSCL 20/5

This third quarter status report of the University of Arizona Optical Sciences Center presents results of work in program areas supported entirely or in part by USAF contract FO 4701-75-C-0248. Specifically covered in this report are CO2 laser frequency, gratings, lateral shear interferometers, mathematical optics, and optical wavefronts. Also included is a list of professional publications and activities of Optical Sciences Center personnel. Author (GRA)

N77-14454# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
CHEMICAL LASER ADVANCED NOZZLE DEVELOPMENT Final Report
R. A. Dickerson, L. J. Zajac, and S. C. Hurlock Jun. 1976 146 p refs
(Contract F29601-73-A-0034-0005; AF Proj. 2861)
(AD-A027630; R-9887; AFWL-TR-76-45) Avail: NTIS HC A07/MF A01 CSCL 20/5

This report describes experimental and analytical efforts conducted to develop a new chemical laser nozzle concept, the tri-stream (or three-stream) chemical laser nozzle. This nozzle expands the cavity fuel and the fluorine atom (combustor effluent) flows through the same nozzle. The fluorine and cavity fuel streams are separated by a layer of diluent flow to inhibit intermixing and reaction of the fluorine atom and cavity fuel in the nozzle. These three streams (fluorine atom, diluent, and cavity fuel) form a basic unit, or element, of the device, and the number of elements per unit length of nozzle is the most important parameter affecting the achievable performance. Tri-stream nozzles were designed, fabricated, and tested in 2.5-inch-long by 0.4-inch-high nozzle exit configurations. Laser power tests of the tri-stream nozzles were conducted in a free-jet test facility capable of pumping to cavity pressures as low as 2.5 torr. The maximum specific power achieved with DF* lasing using all helium diluent was slightly in excess of 80 kJ/lb. The maximum DF* specific power achieved with N2 nozzle diluent was approximately 60 kJ/lb. GRA

N77-14455# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
DE-ICING USING LASERS
Jean W. Lane and Stephen J. Marshall Apr. 1976 36 p refs
(DA Proj. 1T1-61102-B-52A)
(AD-A026637; CRREL-76-10) Avail: NTIS HC A03/MF A01 CSCL 08/12

The feasibility of employing a laser to de-ice remote surfaces was investigated. A Nd:Glass laser, wavelength 1.06 micrometers, and a Ruby laser, wavelength 6.943 A were used to irradiate ice grown upon six types of substrates -- asphalt, brass, concrete, aluminum, steel, and stone. It was found that a single pulse, delivered to the interface between the ice and its substrate at a power density of 10 to the 8th power to 10 to the 9th power watts/sq cm, produced fractures 0.1 to 2 cm in diameter for all substrates. If the initial fracture could be propagated by suitable scanning of the optical beam over the interface, the ice could be disrupted and thus removed from the substrate. The technique could also be a useful adjunct to de-icing methods that depend upon the existence of an initial crack. The process of producing the initial fracture was found to be limited by the thickness of the ice, the bubble content of the ice, and the focusing system. GRA

N77-14456# Army Electronics Technology and Devices Lab., Fort Monmouth, N.J.
HIGH EFFICIENCY PENTAPHOSPHATES FOR MINIATURIZED LASER APPLICATIONS
A. Schwartz, M. J. Wade, T. R. Aucoin, and J. G. Gualtieri 1976 13 p refs
(AD-A026154) Avail: NTIS HC A02/MF A01 CSCL 20/5

The requirement for low-threshold high-efficiency laser sources for miniaturized rangefinder and fiber optic communication applications has led to the study of rare earth pentaphosphate compounds. Neodymium pentaphosphate (NdPP) has recently emerged as a promising 1.05 micrometer laser material operating in pulsed and CW modes, with thresholds of the latter reported less than 1 milliwatt. In contrast to doped lasers such as Nd:YAG, NdPP is a stoichiometric compound (NdP5O14) which accommodates up to thirty times more Nd than YAG. The evaluation and testing of NdPP lasers in prototype components using transverse and longitudinal optical pumping has been hindered due to the limited size (several mm), availabilty, and quality of the single crystals. We have devised unique modifications of conventional solution growth techniques in order to control reaction kinetics and precipitation rates. The largest bulk single crystals (greater than 1 cm) of yttrium and lanthanum substituted NdPP presently available were grown by these modified techniques. We have observed laser action in as-grown 90% Nd 10% Y pentaphosphate crystals with dimensions typically 4.5x3 mm in diamond-shaped cross section by 2 mm thick. GRA

N77-14457# Harry Diamond Labs., Adelphi, Md.
TUNABLE MERCURY CADMIUM TELLURIDE INFRARED LASERS
Joseph P. Sattler, Bruce A. Weber, and Joseph Nemarich 1976 14 p refs
(AD-A026151) Avail: NTIS HC A02/MF A01 CSCL 20/5

We report the development of the first tunable spin-flip Raman laser (SFRL) using crystals of the semiconductor alloy mercury cadmium telluride (Hg(1-x)Cd(x)Te). In addition, tunable recombination laser emission has also been observed. When optically pumped by a carbon dioxide (CO2) laser, the crystals emit laser radiation that is magnetically tunable in the 9 to 11-micrometer wavelength range. Improved crystal technology should permit extension of this tunable range. Potential applications for these lasers are as local oscillators for infrared heterodyne receivers, as high-brightness, high-resolution sources for determining the laser transmission properties of the atmosphere, and as sources for covert, short-range communications links and isotope separation. Experiments were performed with mercury cadmium telluride crystals that were designed to have their absorption edge in near wavelength coincidence with the various lines available from CO2 laser. The crystals were held at near-liquid-helium temperature, and placed in the field of a superconductive or conventional electromagnet. Both pulsed and cw tunable laser radiations were achieved. Thus far, most of the spectral gaps between the lines of a conventional CO2 laser have been filled using these new tunable lasers. GRA

N77-14458# Science Applications, Inc., Arlington, Va.
VISIBLE LASER RESEARCH AND ANALYSES Final Report, Apr. 1974 - Feb. 1976
R. L. Burnham, J. I. Connolly, Jr., and F. Smith Feb. 1976 52 p refs
(Contract N00014-74-C-0394)
(AD-A026186; SAI-76-527-WA) Avail: NTIS HC A04/MF A01 CSCL 20/5

This report summarizes the results of several studies relevant to the development of new electronic state lasers. Initial work was focussed on developing a diagnostic facility to perform laser induced fluorescence spectroscopy. This facility was used to measure the radiative lifetime of the transient species HgBr. In a related effort a long path preionized discharge device was set up to explore alternatives to e-beam initiation. The operation of this device resulted in the first demonstration of discharge pumping of a rare gas halide laser, XeF. Author (GRA)

N77-14459# Cornell Univ., Ithaca, N.Y.
STUDY OF MOLECULAR LASERS Annual Report, 1 Oct. 1974 - 30 Sep. 1975
George J. Wolga, Simon H. Bauer, Ross A. McFarlane, and Terrill A. Cook Nov. 1975 85 p refs
(Contract N00014-67-A-0077-0006; ARPA Order 2062)
(AD-A026227) Avail: NTIS HC A05/MF A01 CSCL 20/5

Research concerning molecular and chemical lasers was conducted in the following areas: (1) Vibrational relaxation measurements at T=300 K of HF(v=1),DF(v=1), CO2(001); (2) Collisional deactivation of CO(v=1) by oxygen atoms over the temperature range 273K to 390K; (3) Vibrational relaxation measurements in the HF-DF, HF-CO2 and DF-CO2 systems at very low temperatures; (4) Studies directed toward the measurement of the V to R rates of energy transfer in HF - HF collisions; (5) Studies directed towards the rapid generation of electronically and/or vibrationally excited boron containing di and triatomics; (6) Reaction rate studies between B, BH, BH2 or BH3 radicals with oxidizers such as NF3, N2O and NO2; and (7) Homogeneous initiation of chemical reactions by pulsed laser heating. GRA

N77-14460# Harry Diamond Labs., Adelphi, Md.
A TWO-SPECIES LASER MODEL WITH EXCITATION ENERGY TRANSFER
Nick Karayianis, Clyde A. Morrison, and Donald E. Wortman May 1976 22 p refs
(DA Proj. 1T1-61102-A-11D)
(AD-A026277; HDL-TR-1753) Avail: NTIS HC A02/MF A01 CSCL 20/5

A theoretical model is proposed for a laser system with two types of active ingredients--one with three energy levels that is capable of population inversion and a second that transfers energy to the former to aid in this inversion. Some properties of the model are examined under continuous-wave and Q-switched operations, to establish a theoretical insight regarding the behavior of multiply doped systems such as LiYF4 doped with Ho, Tm, and Er. Concentration, temperature, and cavity Q dependences are introduced in simple, nontrivial ways, but are not fully explored in this preliminary report. GRA

N77-14461# Stanford Univ., Calif. Edward L. Ginzton Lab.
OPTICAL PUMPING OF MOLECULAR GASES Annual Report, 1 Apr. 1975 - 31 Mar. 1976
Robert L. Byer Apr. 1976 38 p refs
(Contract F44620-74-C-0039; AF Proj. 9751)
(AD-A026295; SU-GL-2562; AFOSR-76-0695TR) Avail: NTIS HC A03/MF A01 CSCL 20/5

During the past year we have completed optical pumping studies of Na2 and have initiated optical pumping studies of CO and Hg2. Optical pumping of Na2 shows that it is potentially an interesting quasi tunable, high gain dimer laser in the .52-.81 micrometer spectra range. Our results show that Na2 could possibly be pumped by a flashlamp or an electrical discharge. Measurements on optically pumping Hg2 show that 2mJ of .266 micrometer radiation is needed to achieve threshold on the .33 micrometer band. Experiments are in progress to achieve lasing in Hg2. Author (GRA)

N77-14462# Maryland Univ., College Park. Dept. of Aerospace Engineering.
KINETICS OF ADVANCED GASDYNAMIC LASERS Final Report, 1 Jul. - 31 Oct. 1975
John D. Anderson, Jr. May 1975 9 p refs
(Grant AF-AFOSR-2575-74; AF Proj. 9750)
(AD-A026296; AFOSR-76-0173TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

A short survey of gasdynamic lasers was made, and a study of advanced fuels for combustion-driven gasdynamic lasers was completed and published. The proper kinetic rate equations for HF chemical lasers were incorporated into the previously reported cold-flow Navier-Stokes solutions. These calculations introduce a new third generation of chemical laser analysis. Author (GRA)

N77-14463# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
OPTICAL PROPERTIES OF EUROPIUM-DOPED POTASSIUM CHLORIDE LASER WINDOW MATERIALS Interim Technical Report, 1 May - 31 Dec. 1975
Thomas G. Stoebe, Robert J. Spry, and John F. Lewis Apr. 1976 31 p refs
(AF Proj. 7371)
(AD-A026363; AFML-TR-76-20) Avail: NTIS HC A03/MF A01 CSCL 20/5

Optical properties of samples from a large KCl:Eu crystal, produced by the Harshaw Chemical Company as part of the AFML laser window development program, have been investigated over a wide spectral region. Absorption bands due to Eu(++), which occur near 2,400 and 3,300 A in the ultraviolet, are used to monitor the Eu-ion content in the samples. The overall Eu(++) content varies throughout the sample according to the expected distribution of this ion during solidification, with the Eu(++) content increasing from cone to heel. An analytical relationship between absorption coefficient and concentration for Eu(++) is derived. Irradiation to 10 to the 8th power R is shown to modify the Eu(++) absorption spectrum, decreasing the Eu(++) absorption peak heights, and shifting the 2,400 A band toward longer wavelengths. The latter may be due to the growth of a new band near 2,700 A. Attempts to detect Eu(3+) in irradiated samples of on oxidized regions were successful, and the evidence indicates that Eu(3+) does not form in these samples. Author (GRA)

N77-14464# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
VARIABLE-APERTURE CALORIMETER FOR AN UNSTABLE RESONATOR Interim Report
Richard A. Chodzko, Stephen B. Mason, Robert R. Giedt, and Donald A. Durran 1 Jun. 1976 23 p refs
(Contract F04701-75-C-0076)
(AD-A026576; TR-0076(6940)-2; SAMSO-TR-76-114) Avail: NTIS HC A03/MF A01 CSCL 20/5

A new technique for measuring the output power from a cw edge-coupled unstable resonator has been developed and applied to a cw DF laser. An internal-cavity calorimeter was used that permits measurement of output power with a variable rectangular-mode geometry while containing the radiation inside the resonator. The variable aperture calorimeter-absorbing scraper (VACAS) device consists of an absorbing copper plate calorimeter assembly, which replaces the 45-deg output coupling mirror of a conventional edge-coupled unstable cavity. GRA

N77-14465# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
CN PRODUCTION EFFICIENCIES FROM ACTIVE NITROGEN-HYDROCARBON FLAMES Interim Report
G. A. Capelle and S. N. Suchard 1 Jun. 1976 30 p refs
(Contract F04701-75-C-0076)
(AD-A026638; TR-0076(6751)-2; SAMSO-TR-76-113) Avail: NTIS HC A03/MF A01 CSCL 20/5

Various hydrocarbons have been reacted with active nitrogen in a supersonic flow system. The resulting chemiluminescence was invariably dominated by CN A doublet Pi and B doublet sigma(+) to X doublet sigma(+) emission. The intensity of this emission and the excited-state vibrational temperatures were strongly dependent upon the reactant hydrocarbon. Photon yields as high as 18.5% were measured for CN A doublet Pi to X doublet sigma(+) emission when C2F4 was used as a reactant, which makes this system a very promising chemically pumped laser. Calculations have shown that, if the populations in the electronically excited states can be vibrationally cooled, it should be possible to achieve positive gain in the system. GRA

N77-14466# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ANNULAR CONVERGING WAVE CAVITY Interim Report
R. A. Chodzko, S. B. Mason, and E. F. Cross 1 Jun. 1976 40 p refs
(Contract F04701-75-C-0076)
(AD-A026917; TR-0076(6605)-2; SAMSO-TR-76-115) Avail: NTIS HC A03/MF A01 CSCL 20/5

A new type of resonator that generates an annular geometric mode by use of spherical mirrors has been developed. The four-element cavity consists of an external confocal unstable resonator with a double-sided 45-deg coupling mirror and a flat feedback mirror. The flat feedback mirror is placed on the plane

wave side of the confocal cavity to form an annular mode between the feedback mirror and the coupling mirror. A plane annular wave (matched to an annular gain medium) is fed back into the unstable resonator, which alternatively converges and diverges to produce a diverging annular output beam. Experiments were performed on a CW HF laser. Observations of mode patterns on the flat feedback mirror, the convex mirror, and of far-field beam quality were made. Far-field measurements indicated near-diffraction-limited beam quality for a peak on-axis intensity mode on the convex mirror. A nearly uniform annular mode was observed on the flat feedback mirror. Author (GRA)

N77-14467# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPARATIVE ANALYSIS OF BIREFRINGENT TUNING DEVICES FOR DYE LASERS M.S. Thesis
Donald E. Lumpkin Jun. 1976 96 p refs
(AD-A027152; GEO/PH/76J-5) Avail: NTIS HC A05/MF A01 CSCL 20/5

Lasers can be made using organic dyes as the lasing medium. The output signal for such a laser covers a large spectral range. When a frequency selective device is inserted in the lasing cavity, the output signal can be narrowed without loss of output power. If the passband of the intracavity device is variable a tunable laser can be produced. In search of a simple highly-transparent tuning device, four birefringent filters using various tuning techniques have been analyzed and compared. Three of the filters use a combination of linear polarizers and retardation plates to produce a tunable output. The fourth device, called a tilted plates filter, uses only retarders. The retarders are inserted in the lasing cavity at Brewster's angle so as to form a partial polarizer. The criteria used for comparing the devices are insertion loss, resistance to optical damage, and simplicity. All of the filters are satisfactory with respect to optical damage having a damage threshold on the order of 1 gigawatt/sq cm. With respect to the other two criteria, the tilted plates filter is found to be superior. To produce a filter with a 10A lasing bandwidth and a 600A tuning range, two retarders are required. For tuning, these retarders are rotated so as to maintain the Brewster angle orientation with the laser axis. The insertion loss for the tilted plates filter is only 0.04% per pass when the filter is made using calcite and 2.3% per pass when quartz is used. The thin crystals required render a calcite filter impractical. Author (GRA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N77-14468 Polish Academy of Sciences, Warsaw.
A STUDY OF RHEOLOGICAL CHARACTERISTICS OF OILS IN THE AREA OF VISCOELASTIC RELAXATION [BADANIE REOLOGICZNYCA WLASCIWOSCI OLEJOW W OBSZARZE RELAKSACJI LEPKOSPREZYSTEJ]
Ryszard Plowiec 22 Dec. 1975 147 p refs In POLISH
Avail: Issuing Activity

With the purpose of learning more about the behavior of lubricating oils in connection with deformation frequency, the rheological peculiarities of a selected silicon oil (trifluoropropyl methyl siloxane) were studied with the use of ultra and hypersonic deformations. Samples of oil with different chain lengths were analyzed in order to establish the influence of its length on the rheological characteristics of the oil and its limited elasticity to breakdown. It is demonstrated that a connection exists between the retardation susceptibility of an oil (which is associated with the spatial orientation of the molecule) and its viscosity. For all the oil samples, frequencies and time spectra of retardation and relaxation are determined along with their mutual correlation and percentage of viscosity and elasticity in individual relaxation processes. Author

N77-14469 Polish Academy of Sciences, Warsaw.
CHANGE IN THE MORPHOLOGY OF A SURFACE IN CONDITIONS OF ROLLING FRICTION. A ROLLER STAND FOR STUDYING CONTACT STRENGTH OF AN UPPER LAYER [ZMIANA MORFOLOGII POWIERZCHNI W WARUNKACH TARCIA TOCZNEGO. STANOWISKO ROLKOWE DO BADANIA WYTRZYMALOSCI KONTAKTOWEJ WARSTWY WIERZCHNIEJ]
Jan Dekert 27 Nov. 1975 29 p refs In POLISH
Avail: Issuing Activity

Change in the morphology of a surface in the process of rolling friction is investigated. The effect of a uniaxial state of stress on contact strength is studied. A special friction stand is adapted for studying flat samples in conditions of rolling friction given a uniaxial state of stress in the presence of a lubricating medium. In the 'lapping' stage of the process, a rapid decrease in unevenness height is observed, both with and without a lubricant. The sample without lubricant undergoes significant oxidation and corrosion. Distending pressures are found to have an influence on the rise of pitting. A measuring apparatus is designed for the study of the effect of loading, speed of slip, type of machining, geometric errors, structure of material, etc. on the endurance of an upper layer to pitting. Author

N77-14470 Polish Academy of Sciences, Warsaw.
DYNAMIC EQUILIBRIUM OF A MOTOR VEHICLE IN OBLIQUE AIR FLOW [ROWNOWAGA DYNAMICZNA POJAZDU SAMOCHODOWEGO PRZY SKOSNYM OPLYWIE POWIETRZEM]
Andrzej Nalecz 22 Jan. 1976 65 p refs In POLISH
Avail: Issuing Activity

The state of dynamic equilibrium of a motor vehicle affected by lateral wind is presented. The state of equilibrium is defined by the Lagrange-Dirichlet theorem which can be used as a holonomic or nonholonomic system. These systems are compared. The dynamic model of a motor vehicle is described and equilibrium equations are derived. The forces and aerodynamic moments acting on the vehicle in lateral wind are discussed in detail. Author

N77-14471 Polish Academy of Sciences, Warsaw.
A CERTAIN METHOD OF SUBOPTIMAL CONTROL OF A NONLINEAR MECHANICAL SYSTEM WITH MANY DEGREES OF FREEDOM [PEWNA METODA SUBOPTYMALNEGO STEROWANIA NIELINIOWEGO UKLADU MECHANICZNEGO O WIELU STOPNIACH SWOBODY]
Andrzej Tomczyk 5 Mar. 1976 99 p refs In POLISH
Avail: Issuing Activity

The effect of nonlinearity of equations of state on coefficients of reinforcement of a regulator in the instance of determined forces of the nature of a unit function is analyzed. External forces acting on the system which are stochastic processes are studied. The method of synthesizing suboptimal control of nonlinear dynamic systems was used to solve a problem of stabilizing symmetric motion of an airplane, and it gave good results, improving the quality of stabilization. Author

N77-14472 Polish Academy of Sciences, Warsaw.
LIMITAL STATICALLY PERMISSIBLE DISCONTINUOUS STRESS FIELDS FOR ESTIMATING LIMITAL LOAD CAPACITY, PART 2 [GRANICZNE STATYCZNIE DOPUSZCZALNE NIECIAGLE POLA NAPREZEN DLA SZACOWANIA NOSNOSCI GRANICZNEJ, CZESC 2]
W. Szczepinski 24 Feb. 1976 222 p refs In POLISH
Avail: Issuing Activity

Tables of results for the solutions of basic systems of lines of discontinuity are presented. A method of utilizing the tables which make it possible to construct complex stress fields in estimating load capacity of diverse machinery and construction elements is provided. All the data for systems of lines of discontinuity and elementary stress fields calculated for the Huber Mises condition are correct only for a flat state of stress. Author

N77-14473 Polish Academy of Sciences, Warsaw.
LIMITAL STATICALLY PERMISSIBLE DISCONTINUOUS STRESS FIELDS FOR ESTIMATING LIMITAL LOAD CAPACITY, PART 3 [GRANICZNE STATYCZNIE DOPUSZCZALNE NIECIAGLE POLA NAPREZEN DLA SZACOWANIA NOSNOSCI GRANICZNEJ, CZESC 3]
W. Szczepinski 24 Jan. 1976 160 p refs In POLISH
Avail: Issuing Activity

A table was compiled for an elementary field with the application of the Huber Mises condition of plasticity. Results in the table are appropriate only for a flat state of stress. Unidimensional values of stresses S sub 1/SIG and S sub 2/SIG calculated for a plasticity limit taken for a unit = 1.0 are presented. Only those unidimensional parameters calculated for one of the dimensions taken for the unit a = 1.0, which are needed to delineate and apply a field in complex systems of lines of discontinuity are presented. Author

N77-14474 Polish Academy of Sciences, Warsaw.
LIMITAL STATICALLY PERMISSIBLE DISCONTINUOUS STRESS FIELDS FOR ESTIMATING LIMITAL LOAD CAPACITY, PART 4 [GRANICZNE STATYCZNIE DOPUSZCZALNE NIECIAGLE POLA NAPREZEN DLA SZACOWANIA NOSNOSCI GRANICZNEJ, CZESC 4]
W. Szczepinski 24 Jan. 1976 172 p refs In POLISH
Avail: Issuing Activity

A table was compiled to resolve a field given the Treska plasticity condition. The table includes only those unidimensional parameters computed for one of the dimensions of the field taken for the unit (a = 1.0) which are necessary for delineating and applying the field in establishing systems of lines of discontinuity. The table makes it possible to construct a more complex field of stresses in estimating the load capacity of diverse machine and construction elements, a few examples of which are presented. Author

N77-14475 British Library Lending Div., Boston Spa (England).
THE JOINING OF PARTS OF SHOES USING ULTRASONIC VIBRATIONS
Yu. M. Ivanova Sep. 1976 6 p refs Transl. into ENGLISH from Kozhevenno-Obuunaya Prom. (USSR), vol. 11, 1975 p 57-59
(BLL-RTS-10304) Avail: British Library Lending Div., Boston Spa, Engl: £7.50; 7 BLL overseas or 30 UK BLL photocopy coupons

The use of the ultrasonic method to obtain welded and adhesive welded joints using parts manufactured from various materials with different properties was examined. The range of these materials and the adjacent placing of materials to be joined were chosen with regard to practice in the technology of footwear production. Polyurethane glue was used as the adhesive for obtaining adhesive welded joints. Before welding, specimens were coated to a thickness of 7mm using the method specified for polyurethane glue. The work was carried out on the basis of an ultrasonic welding machine. Author

N77-14476 British Library Lending Div., Boston Spa (England).
ET AXIAL PISTON UNITS. VARIABLE DISPLACEMENT; DUAL DESIGN
Feb. 1975 87 p Transl. into ENGLISH from Brueninghaus Hydraulik GmbH (West Ger.), Feb. 1975 p 1-37
(BLL-NEL-TT-2670-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.

Small external dimensions, a high power to weight ratio, and low moments of inertia are achieved in axial piston units. Setting times are short, and precise mounting of the cylinder block ensures a high accuracy of setting with small setting forces. Drive shaft bearing ensures long service life and permits loading by lateral forces at the end of the shaft. The bent axis design permits high starting torques when used as a hydraulic motor. The kinematic principle of this axial piston unit is that of a three dimensional crank-drive assembly, which when used as a pump converts the rotary motion of the input shaft into a translatory motion of the piston. When used as a hydraulic motor, the conversion of the mode of motion is reversed. The dual pumps can be fitted with an additional output drive, so that a third unit can be connected. Author

N77-14477* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FIFTH WHEEL Patent
William P. Albrecht and Ralph H. Sparks, inventors (to NASA) Issued 7 Dec. 1976 9 p Filed 22 Jul. 1975 Supersedes N75-29432 (13 - 20, p 2526)
(NASA-Case-FRC-10081-1; US-Patent-3,995,877; US-Patent-Appl-SN-598504; US-Patent-Class-280-432) Avail: US Patent Office CSCL 13I

An improved fifth wheel for a tractor trailer rig, characterized by a first subassembly including a wear plate was developed and modified to be mounted on a downwardly facing surface of a trailer. A king pin projected normally therefrom, and a second subassembly is adapted to be pivotally mounted on an upwardly facing surface of a tractor. The king pin is brought into contiguous relation with the first sub assembly. A receiver for capturing the king pin is included along with a safety means responsive to a failure of the king pin or its latching mechanism for joing the first subassembly with the second subassembly.
Official Gazette of the U.S. Patent Office

N77-14478* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRECISION ALINEMENT APPARATUS FOR CUTTING A WORKPIECE Patent
Morriss L. Holliday, inventor (to NASA) Issued 7 Dec. 1976 4 p Filed 24 Oct. 1975 Supersedes N76-13494 (14 - 04, p 0458)
(NASA-Case-LAR-11658-1; US-Patent-3,995,522; US-Patent-Appl-SN-625759; US-Patent-Class-83-467R; US-Patent-Class-83-451) Avail: US Patent Office CSCL 13I

A fixture is removably fixed to a workpiece providing a temporary reference edge positioned parallel to a reference line and a known distance from a reference point. The temporary reference edge in cooperation with a guide and a cutting blade of a cutting table enables the workpiece to be accurately cut with respect to the reference line and reference point without first having to cut a reference edge on the workpiece.
Official Gazette of the U.S. Patent Office

N77-14479* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REEL SAFETY BRAKE Patent
Clinton E. Carle, inventor (to NASA) Issued 7 Dec. 1976 9 p Filed 6 Nov. 1975 Supersedes N76-13495 (14 - 04, p 0459)
(NASA-Case-GSC-11960-1; US-Patent-3,995,789; US-Patent-Appl-SN-629456; US-Patent-Class-242-193; US-Patent-Class-242-57; US-Patent-Class-242-187; US-Patent-Class-242-204; US-Patent-Class-242-210) Avail: US Patent Office CSCL 13I

A braking apparatus is described for a tape transport device having two stacked coaxial reels and feelers mounted in proximity to the reels for sensing the tape being wound on each reel. A device is mounted in proximity to adjacent central hubs of the reels to a simultaneously, frictionally engage both hubs and brake both reels. A mechanical actuator is coupled to both feelers and to the brake device. The brake means comprises a pair of rubber shoulders that extend in opposite directions relative to a common axis, and turns about the axis in response to either of the feelers. Official Gazette of the U.S. Patent Office

N77-14480 British Library Lending Div., Boston Spa (England).
CALCULATION OF A DEFORMABLE FLYING OBJECT AGAINST A DEFORMABLE OBSTACLE
K. Drittler, P. Gruner, and J. Krivy 30 Jun. 1976 25 p refs Transl. into ENGLISH of Inst. fuer Reaktor Sicherhit Report IRS-W-20
(BLL-Risley-Tr-3043-(9091.9F); IRS-W-20) Avail: British Library Lending Div., Boston Spa, Engl.

A formalism based on Riera's model is presented, by means of which impact forces upon a deformable target, i.e. a target which yields during impact, are calculated. Perforation of the target is excluded. This method is applied to the crashing of a fast military aeroplane impacting with various velocities. It is assumed that during impact the target yields up to 0.5 m. The comparison with other calculations on the basis of rigid targets shows that the prescribed motion of the target only slightly affects the magnitude of the impact force. Author

N77-14481 British Library Lending Div., Boston Spa (England).
CALCULATION OF THE PACKING PRESSURE AT THE SHAFT AND FLANGE OF A BOBBIN
V. A. Stepanov and G. N. Rusanova Sep. 1976 9 p refs Transl. into ENGLISH from Izvestiya VUZ Tekhnologiya Tekstil Promyshlennosti (USSR), v. 106, no. 3, 1975 p 58-62
(BLL-RTS-10329) Avail: British Library Lending Div., Boston

Spa, Engl.: £7.50; 7 BLL overseas or 30 UK BLL photocopy coupons

The practical utilization of equations obtained for pressure determination on a flangeless cylindrical holder is complicated by the complexity of coefficient calculation. It is proposed that equations should be calculated for pressure determination at the shaft and flange as a function of winding stress of the material and thickness of the winding, taking into account the stress relaxation. Author

N77-14482 Cincinnati Univ., Ohio.
VALIDATION OF A TURBULENT FLAME PROPAGATION MODEL FOR AN INTERNAL COMBUSTION ENGINE Ph.D. Thesis
Frederick Douglass McCuiston, Jr. 1976 104 p
Avail: Univ. Microfilms Order No. 76-25129

An analytical and experimental investigation of the combustion process in a spark ignition engine was performed. The analysis is based on a flame propagation model developed by Blizard and Keck which in turn is based on an earlier turbulent flame theory formulated by Damkohler and Shchelkin. The model was validated through a rigorous solution of the combustion equations consistent with the original concept of the model. A study was performed to show the range of solutions that can be obtained by varying the input parameters that define the model. The model assumes that turbulent eddies having a characteristic radius entrained at a turbulent flame velocity and subsequently burn in a characteristic time equal to the eddy radius divided by the laminar flame speed. The flame propagation model was incorporated into the thermodynamic engine simulation model developed by Blumberg and it replaces the cosine burning law. Dissert. Abstr.

N77-14483*# Vanderbilt Univ., Nashville, Tenn. Dept. of Mechanical Engineering and Materials Science.
DISCRETE COMPONENT BONDING AND THICK FILM MATERIALS STUDY Final Report, 1 Sep. 1975 - 30 Sep. 1976
D. L. Kinser 3 Dec. 1976 81 p refs
(Contract NAS8-30883)
(NASA-CR-150129) Avail: NTIS HC A05/MF A01 CSCL 11A

The bonding reliability of discrete capacitor chips bonded with solders and conductive epoxies was examined along with the thick film resistor materials consisting of iron oxide phosphate and vanadium oxide phosphates. It was concluded from the bonding reliability studies that none of the wide range of types of solders examined is capable of resisting failure during thermal cycling while the conductive epoxy gives substantially lower failure rates. The thick film resistor studies proved the feasibility of iron oxide phosphate resistor systems although some environmental sensitivity problems remain. One of these resistor compositions has inadvertently proven to be a candidate for thermistor applications because of the excellent control achieved upon the temperature coefficient of resistance. One new and potentially damaging phenomenon observed was the degradation of thick film conductors during the course of thermal cycling. Author

N77-14484*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FATIGUE LIFE ANALYSIS FOR TRACTION DRIVES WITH APPLICATION TO A TOROIDAL TYPE GEOMETRY
John J. Coy, Stuart H. Loewenthal, and Erwin V. Zaretsky Washington Dec. 1976 33 p refs Prepared in cooperation with the US Army Air Mobility R and D Lab.
(NASA-TN-D-8362; E-8737) Avail: NTIS HC A03/MF A01 CSCL 13I

A contact fatigue life analysis for traction drives was developed which was based on a modified Lundberg-Palmgren theory. The analysis was used to predict life for a cone-roller toroidal traction drive. A 90-percent probability of survival was assumed for the calculated life. Parametric results were presented for life and Hertz contact stress as a function of load, drive ratio, and size. A design study was also performed. The results were compared to previously published work for the dual cavity toroidal drive as applied to a typical compact passenger vehicle drive train. For a representative duty cycle condition wherein the engine delivers 29 horsepower at 2000 rpm with the vehicle moving at 48.3 km/hr (30 mph) the drive life was calculated to be 19,200 km (11 900 miles). Author

N77-14485# Oak Ridge Y-12 Plant, Tenn.
APPLICATION OF FEEDBACK CONTROL FOR MACHINING CYLINDERS TO CONSTANT THICKNESS
L. E. Carey, R. E. Hewgley, Jr., and W. L. Green (Tennessee Univ., Knoxville) 3 Mar. 1976 5 p refs Presented at IEEE Southeastern Conf., Knoxville, Tenn., Apr. 1976
(Contract W-7405-eng-26)
(Y-DA-6614; Conf-760408-5) Avail: NTIS HC A02/MF A01

The development of a closed-loop feedback system for machining the walls of a metal cylinder to a constant thickness is described. ERA

N77-14486# Addis Translations International, Portola Valley, Calif.
HYBRID DRIVE WITH KINETIC ENERGY STORE AS VEHICLE DRIVE
H. Schreck and F. Torres Feb. 1976 18 p refs Transl. into ENGLISH of conf. paper from Tech. Univ., Aachen Presented at 2d Symp. on Low-Pollution Power-System Develop., Dusseldorf, Nov. 1974 Sponsored by ERDA Prepared for California Univ., Livermore. Lawrence Livermore Lab.
(UCRL-Trans-11018; Conf-741151) Avail: NTIS HC A02/MF A01

Conventional motor vehicles have very high fuel consumption when traveling in city traffic. The reason for this lies in the absence of energy regeneration during braking and in uneconomical part load consumption of the internal combustion engine. Fuel consumption can be reduced considerably by using a hybrid drive with a gyro component. Road tests show that the fuel consumption is reduced by 40 to 45 percent below that of transport vehicles with conventional engines. ERA

N77-14487# Goodyear Atomic Corp., Piketon, Ohio. Dept. of Materials Technology.
LABORATORY EVALUATION OF COMPRESSOR BLADES CONSIDERED FOR USE IN CIP/CUP COMPRESSORS
Kenneth L. Ritchie 30 Apr. 1976 37 p refs
(Contract E(32-2)-1)
(GAT-838) Avail: NTIS HC A03/MF A01

Four die casting alloys, the external pressure pin and conventional casting methods, an accelerated aging heat treatment, and an airfoil fillet modification were evaluated for 33F-S1 compressor blades considered for use in axial flow compressors installed during the cascade improvement and uprating programs at the three gaseous diffusion plants. Based on castability, resonant frequency, resistance to fatigue cracking, and shank breaking load, the ranking of the four alloys from highest to lowest is GAT2, 214X, X224, and D-15. The GAT2 alloy ranked highest in all categories except impact value; the impact values of both X224 and 214X alloys exceeded that of the GAT2 alloy, thus indicating the latter is relatively more brittle. Author (ERA)

N77-14488# General Electric Co., Schenectady, N.Y. Gas Turbine Products Div.
HIGH TEMPERATURE GAS TURBINE ENGINE Annual Report for 1975
Saul M. Kaplan 30 Jan. 1976 95 p refs
(Contract E(49-18)-1765)
(FE-1765-8) Avail: NTIS HC A05/MF A01

Selection of materials to be tested and the preparation of test specimens of these have been completed. Coal feedstocks to be used for low-Btu gas tests and also requirements for both samples of these and acquisition of data during Initial Low-Btu Testing have also been completed. Test facility and test specimen arrangements for initial coal derived liquid fuel tests are complete and have been checked out; GE furnished test equipment for Initial Low-Btu Gas tests at ERDA/MERC will be delivered to ERDA/MERC by February 1. ERA

N77-14489# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
DATA REDUCTION OF SINGLE STAGE COMPRESSOR Final Report, Jun. 1974 - Jun. 1975
James W. Connell Jun. 1975 151 p refs

(AF Proj. 7065)
(AD-A026675; ARL-75-0192) Avail: NTIS HC A08/MF A01 CSCL 13/7

A revised computer program to process raw data for experimental compressor test evaluations is presented. The data processing program converts raw data into engineering units, groups and displays the acquired data in a readable format, provides an initial analysis of compressor stage performance, and prepares a data deck for a secondary aerodynamic analysis. The computer program reduces test facility related measurements and compressor stage aerodynamic measurements which have been recorded onto magnetic tape. An earlier program has been revised to provide an improved method for evaluating compressor stage efficiency and flow rate, ability to reduce flow angle data when available, and to provide for easy editing of the raw data when required. The complete computer program, description of its use, and a sample case are included in the report.
Author (GRA)

N77-14490# DARCOM Intern Training Center, Texarkana, Tex.
INVESTIGATION OF THE DESIGN, MANUFACTURING, AND INSPECTION FOR THE WELDING CATEGORY 1 SUPPRESSIVE SHIELDING Final Report
George C. Manthey May 1976 45 p refs
(AD-A026291; DARCOM-ITC-02-08-76-2) Avail: NTIS HC A03/MF A01 CSCL 13/8

This paper studies the welding aspect of suppressive shielding with a weldment estimation and areas of improvement in the welding process should the shield be put into production. Also, contained in the report is an analysis for inspection.
Author (GRA)

N77-14491# Mechanical Technology, Inc., Latham, N.Y.
ADVANCED COMPRESSOR SEAL FOR TURBINE ENGINES Final Technical Report
Anthony J. Smalley and Peter R. Albrecht 10 Feb. 1976 103 p refs
(Contract F33615-73-C-2043; AF Proj. 3066)
(AD-A026916; MTI-75-TR59; AFAPL-TR-75-66) Avail: NTIS HC A06/MF A01 CSCL 21/5

This report describes a resilient seal concept entitled the J-Seal. This concept uses a pressure loaded membrane and hydrostatic bearing principles to maintain a minimum rotor stator clearance over a range of axial rotor displacement. Methods of analyzing this concept have been developed. A design study is presented and hardware has been fabricated. Manufacturing inadequacies in a key component caused proof of concept testing to be inconclusive, but an adequate test rig for high-temperature testing has been constructed.
Author (GRA)

N77-14492# Southwest Research Inst., San Antonio, Tex.
A STUDY TO OBTAIN VERIFICATION OF LIQUID NATURAL GAS (LNG) TANK LOADING CRITERIA Final Technical Report, 11 Jun. 1973 - 2 Jun. 1975
R. L. Bass, J. C. Hokanson, and P. A. Cox 2 Jun. 1975 292 p refs
(Contract N00024-74-C-5136)
(AD-A025716; SSC-258) Avail: NTIS HC A13/MF A01 CSCL 13/4

A study of LNG tank loading criteria is presented that includes a survey and review of load criteria presently employed in the design of cargo tanks for LNG carriers. Motion and acceleration values as determined from these criteria are compared to ship motion calculations and available full-scale data. A comparison of LNG tank loads, as predicted by current classification society and regulatory agency criteria, is given along with recommended updated criteria in each of seventeen load categories. Model tests and fullscale measurement programs to provide adequate data for verification of load and acceleration criteria are also outlined.
Author (GRA)

N77-14493# Construction Engineering Research Lab. (Army), Champaign, Ill.
RFI SHIELDING EFFECTIVENESS OF STEEL SHEETS WITH PARTLY WELDED SEAMS
Ernest M. Honig, Jr. 1976 15 p refs
(AD-A026043) Avail: NTIS HC A02/MF A01 CSCL 09/3

Current specifications, largely unsupported by experimental data, require weld seams in electromagnetically shielded facilities to be radiographically defect-free. These specifications have necessitated spending $1,000,000 for inspection and weld rework at SAFEGUARD missile sites. In a study of the effect of weld defects on the shielding effectiveness of shielded enclosures containing welded seams, Carlson found that weld seams having weld defects under a critical size could provide adequate shielding effectiveness, and that repair of such seams was an unnecessary expense. He suggested that the effect of crack (or slot) width and length on shielding effectiveness be evaluated in a future study that would determine critical sizes for classes of defects and would investigate circumstances in which a flaw might act as resonant antenna.
Author (GRA)

N77-14494# California Univ., Irvine. School of Engineering.
A MODIFIED CONFIGURATION FOR LINEAR MULTIVARIABLE SERVOMECHANISMS
J. S. Meditch and C. A. Wolfe Oct. 1975 10 p refs Presented at the 13th Ann. Allerton Conf. on Circuit and System Theory, Montecello, Ill., 1-3 Oct. 1975; sponsored by Ill. Univ., Urbana-Champaign
(Grants AF-AFOSR-2116-71; NSF GK-37735; AF Proj. 9769)
(AD-A026297; AFOSR-76-0174TR) Avail: NTIS HC A02/MF A01 CSCL 09/3

Recent results on system type for linear multivariable servomechanisms are applied to a previously proposed type r multivariable servomechanism structure to obtain a new configuration. The latter possesses design freedom not present in the first configuration; this permits optimization of certain transient response properties of the closed-loop system without affecting previously specified system type and closed-loop pole location. An example is presented which demonstrates over a 35% improvement in integral-square tracking error relative to that for the original configuration.
Author (GRA)

N77-14495# Aerospace Corp., El Segundo, Calif. Environment and Energy Conservation Div.
RESEARCH PLAN FOR ACHIEVING REDUCED AUTOMOTIVE ENERGY CONSUMPTION
Toru Iura, Wolfgang U. Roessler, and Herbert M. White Oct. 1975 375 p refs
(Grant NSF SIA-74-17662-A02)
(PB-255929/2; ATR-76(7467)-1; NSF/RA-760008) Avail: NTIS HC A16/MF A01 CSCL 21G

The types of engines considered include reciprocating and rotary spark ignition gasoline engines, stratified charge variants, and diesel engines. Also included is an assessment of the impact of the potential use of non-petroleum-based alternative fuels on modified or improved internal combustion engines and the research needed to support such future implementation. The plan defines needed work in the areas of combustion research, materials research, friction reduction, alternative fuels, engine controls, and diagnostic instrumentation research. Emphasis was placed on identification of near-term (to 1985) benefits. A summary of recent and ongoing research programs in the field is also included.
GRA

N77-14496# Naval Postgraduate School, Monterey, Calif.
A COMPARISON OF BUFFER STRIP AND NON-BUFFER STRIP JOINT DESIGNS
James Michael Gill Jun. 1976 163 p refs
(AD-A026460) Avail: NTIS HC A08/MF A01 CSCL 01/3

Buffer strip and non-buffer strip bolted wing skin type joints made from NARMCO 5208/T300 graphite-epoxy material were designed, and the excess bearing capacity and weight of these joints were calculated for a wide range of laminate compositions, bolt hole sizes, and number of bolt holes. Design load conditions representative of an advanced fighter type aircraft were chosen. Joint designs were arbitrarily restrained by assumed manufacturing conditions, assumed interface conditions, and imposed laminate composition restrictions. Charts were prepared from which relative joint efficiencies could be determined, but no attempt was made to analyze the effect of the arbitrary design restrictions. The advantages and penalties for buffer strip design were discussed, and recommendations for future studies were made.
GRA

N77-14497# Air Force Weapons Lab., Kirtland AFB, N.Mex.
PROCEEDINGS OF THE MEETING FOR COORDINATING PRECISION MACHINING OF OPTICS RESEARCH AND REQUIREMENTS Final Report
Theodore T. Saito Jun. 1976 27 p Meeting held at Kirtland AFB, N. Mex., 18 Sep. 1976
(AD-A027093; AFWL-TR-76-4) Avail: NTIS HC A03/MF A01 CSCL 20/6

These proceedings contain an introduction to the meeting including a brief description of the participants and the objectives. The developments and capabilities of Union Carbide Y-12 plant are described in detail. A short summary of the new Moore No. 5 machine at Bendix, Kansas City, Missouri, is included, as well as a description of the use of light scattering for roughness characteristics. The executive summary of the meeting mentions some of the discussions that also followed. Important conclusions of the meeting were that a 5-year lead time is required to obtain a machine and acquire the necessary skills for precision machining, and that demands for diamond turning optics will be increasing. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N77-14498# General Dynamics/Fort Worth, Tex.
RELIABILITY PREDICTION FOR COMPOSITE JOINTS: BONDED AND BOLTED Final Report, 1 May 1973 - 31 Mar. 1974
R. V. Wolff and G. H. Lemon Mar. 1976 110 p refs
(Contract F33615-73-C-5061; AF Proj. 7340)
(AD-A026408; AFML-TR-74-197) Avail: NTIS HC A06/MF A01 CSCL 13/5

An experimental program was conducted on coupon-size graphite-epoxy laminate-to-metal joints. Both adhesively bonded and mechanically fastened joints were tested in fatigue to the same random (Flight-by-flight 0) spectrum to provide lifetime and residual strength data. The empirical data developed for both types of joints was analyzed using structural reliability techniques that included the use of a probabilistic fatigue model previously introduced by Dr. J. C. Halpin of AFML and M. E. Waddoups. The program also included the development of methods for pooling dispersion data to estimate the Weibull shape parameter. Three methods were developed and directly compared: Parameter averaging, normalization, and maximum likelihood. The program was a follow-on to the program reported in ARML-TR-72-121, dated March 1972. GRA

N77-14499# Raytheon Co., Huntsville, Ala. Dept. of Life Cycle Analysis.
STORAGE RELIABILITY OF MISSILE MATERIEL PROGRAM, SOLID PROPELLANT ROCKET MOTOR ANALYSIS Final Report, Jun. 1974 - Jun. 1976
Dennis F. Malik May 1976 55 p refs
(Contract DAAH01-74-C-0853)
(AD-A026105; LC-76-OR1) Avail: NTIS HC A04/MF A01 CSCL 21/8

This report documents findings on the reliability of Solid Propellant Rocket Motors after long term storage. From the data analyzed, aging is indicated for these motors. The aging mechanisms and trends are given together with a reliability prediction model. This information is part of a research program being conducted by the U. S. Army Missile Command, Redstone Arsenal, Alabama. The objective of this program is the development of Non-operating (storage) reliability prediction and assurance techniques for missile materiel. Author (GRA)

N77-14500# Raytheon Co., Huntsville, Ala. Dept. of Life Cycle Analysis.
STORAGE RELIABILITY OF MISSILE MATERIEL PROGRAM. IGNITERS AND SAFE AND ARM DEVICE ANALYSIS Final Report, Jun. 1974 - Jun. 1976
Dennis F. Malik May 1976 48 p refs
(Contract DAAH01-74-C-0853)
(AD-A026938; LC-76-OR2) Avail: NTIS HC A03/MF A01 CSCL 21/8

This report summarizes analyses on the non-operating reliability of missile igniters and safe and arm devices. From the data analyzed aging is indicated for these devices after long term storage. The aging mechanisms and trends are given together with a reliability prediction model. This information is part of a research program being conducted by the U. S. Army Missile Command, Redstone Arsenal, Alabama. The objective of this program is the development of non-operating (storage) reliability prediction and assurance techniques for missile materiel. Author (GRA)

N77-14501# National Bureau of Standards, Washington, D.C. Metallurgy Div.
SUCCESS BY DESIGN: PROGRESS THROUGH FAILURE ANALYSIS. PROCEEDINGS OF THE 21ST MEETING OF THE MECHANICAL FAILURES PREVENTION GROUP Final Report
T. Robert Shives and William A. Willard Jul. 1976 232 p refs Held at Gaithersburg, Md., 7-8 Nov. 1974 Sponsored in part by ONR, Frankford Arsenal, Naval Air Development Center, Warminster, Pa., and FAA
(PB-256770/9; NBS-SP-433; LC-76-608132) Avail: NTIS HC A11/MF A01 CSCL 14D

These proceedings consist of a group of twenty two submitted papers and discussions from the 21st meeting of the Mechanical Failures Prevention Group which was held at the National Bureau of Standards in Gaithersburg, Maryland on November 7-8, 1974. The central theme of the Proceedings was improvement in design through failure analysis. Emphasis was on design philosophy, the use of failure analysis case studies as an educational tool, successful redesign through failure analysis, and design oversights. GRA

N77-14502# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.
ULTRASONIC PROCEDURES FOR THE DETERMINATION OF BOND STRENGTH Interim Report
Joseph L. Rose 1976 38 p refs
(Grant AF-AFOSR-2480-73; AF Proj. 6813; AF Proj. 9782)
(AD-A027704; AFOSR-76-0737TR) Avail: NTIS HC A03/MF A01 CSCL 14/2

Substantial progress was made in developing a sound resource base in model analysis, data acquisition, and signal processing for advancing the state of the art in the ultrasonic inspection of adhesive bonds. A computer program was developed with the capability of calculating the theoretical longitudinal and shear reflections from a homogeneous isotropic adhesion bond due to an obliquely incident longitudinal wave. A fast data acquisition system consisting of a PDP 11/05 minicomputer, Biomation 8100 A/D converter and a Tektronix 4014 graphics display was also developed. Attention is now being placed on examining the ultrasonic inspection potential of additional metal to metal adhesive bonds, and separately, the examination of selected composite materials, the procedures of which use basic concepts presented in this report. GRA

N77-14059*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MODIFICATION OF HIPOTRONICS DISCONTINUITY ENAMEL WIRE TEST FOR WIRE SCREENING
W. D. Schreiner *In its* The Deep Space Network 15 Dec. 1976 p 102-104 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 14D

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N77-14503 Polish Academy of Sciences, Warsaw.
AN ANALYSIS OF CAUCHY'S ELEMENTARY PROBLEM FOR

AN ELASTIC MATERIAL [ANALIZA ZAGADNIENIA POCZATKOWEGO CAUCHYEGO DLA MATERIALU SPREZYSTEGO]

Piotr Borejko 7 May 1976 38 p refs In POLISH

Avail: Issuing Activity

A three-dimensional wave solution of Cauchy's elementary problem for the Toupin-Bernstein motion equation is constructed. The solution nucleus is transformed to a suitable form. The peculiar characteristics of the solution of Cauchy's elementary problem u super i = u super i(x super sigma, t) are studied. It is shown that zones exist between the outermost and innermost branches of the wave surface where this solution is an equivalence function identical to zero. Author

N77-14504 Polish Academy of Sciences, Warsaw.

AN ACCELERATION WAVE IN AN ELASTIC CYLINDER MADE OF COMPRESSIBLE MATERIAL SUBJECTED TO GREAT DEFORMATION [FALA PRZYSPIESZENIA W SPREZYSTYM WALCU ZBUDOWANYM ZE SCISLIWEGO MATERIALU PODDANYM DUZYM ODKSZTALCENIOM]

Krystyna Szpricer-Mogielnicka 5 Mar. 1976 17 p refs In POLISH

Avail: Issuing Activity

Wave propagation for a compressible material was analyzed. The following topics are discussed: basic relations, axio-symmetric deformations, propagation of a surface of discontinuity, acoustic radius and equations of transport. Author

N77-14505 Polish Academy of Sciences, Warsaw.

TECHNOLOGY OF THE STUDY OF PHOTOELASTIC MATERIALS WITH DIVERSE MODULI OF ELASTICITY [TECHNIKA BADANIA WLASNOSCI MATERIALOW ELASTOOPTYCZNYCH O ROZNYCH MODULACH SPREZYSTOSCI]

M. Wolna and I. Slowikowska 3 Feb. 1976 21 p refs In POLISH

Avail: Issuing Activity

The mechanical, photoelastic characteristics of materials are studied. Two basic methods are employed: the method of uniaxial tension or compression of a sample and the method of fine bending. Compositions consisting of the epoxide resin Araldit FRL and the epoxide oligoadypinian glycol diethylene are examined. A few compositions of photoelastic materials with different moduli of elasticity, vitrification temperatures, and optic sensitivity coefficients are prepared. These were hardened by a tri-ethylenotetraamine (TECZA) for a three day period at 55 C. After that time photoelastic studies were made. Author

N77-14506 Polish Academy of Sciences, Warsaw.

THEORY OF FLEXION LINES: TABLES OF SOLUTIONS FOR UNIFORMLY LOADED RECTANGULAR PLATES [TEORIA LINII ZALOMOW TABLICE ROZWIAZAN DLA ROWNOMIERNIE OBCIAZONYCH PLYT PROSTOKATNYCH]

Joanna Sokol-supel 24 Mar. 1976 48 p refs In POLISH

Avail: Issuing Activity

The basics of the flexion-lines method, a set of solutions performed by this method for rectangular plates, examples illustrating the use of the tables and graphs are presented. Author

N77-14507 Polish Academy of Sciences, Warsaw.

A STUDY OF THE DEGREE OF FATIGUE WEAR OF METALS USING THE METHOD OF AMPLITUDE-FREQUENCY CHARACTERISTICS [BADANIE STOPNIA ZUZYCIA ZMECZENIOWEGO METALI METODA CHARAKTERYSTYK AMPLITUDOWOCZESTOSCIOWYCH]

Bohdan Rysinski 20 Feb. 1976 21 p refs In POLISH

Avail: Issuing Activity

In designating the amplitude frequency characteristics of the test setup and test material with a defined degree of fatigue damage, the following parameters are considered: resonance frequency of the layout, coefficient of reinforcement for that frequency and width of the resonance curve. These parameters characterize rigidity and the attenuation coefficient of the layout. Knowing the degree of damage in the material (loading and number of cycles) and the rigidity and coefficient of attenuation, the function of representation of the state of the material at a diagnostic signal can be determined. Author

N77-14508 Polish Academy of Sciences, Warsaw.

A PRELIMINARY EVALUATION OF THE POSSIBILITY OF REPLACING THE DEAD WEIGHT OF A BEAM WITH UNIFORM LOADING ON THE UPPER EDGE [WSTEPNA OCENA MOZ. LIWOSCI ZASTAPIENIA CIEZARU WLASNEGO BELKI OBCIAZENIEM ROWNOMIERNYM NA GORNYM BRZEGU]

R. S. Doroszkiewicz and W. Lozinski 19 Dec. 1976 22 p refs In POLISH

Avail: Issuing Activity

Results of an analysis of stresses in beam walls, in which dead weight is the basic scheme of loading, are reported. A preliminary study of the possibility of utilizing substitutive loading instead of shaping mass forces with the help of twisting is provided. It is shown that loading in the form of pressure uniformly distributed along the upper edge replaces loading by a field of mass forces relatively well forces. The models presented demonstrate that use of substitutive loading instead of shaping the gravitational field with the use of photoelastic twisting can be helpful in determining zones of stretching, dimensioning, and spacing reinforcement. Author

N77-14509 Polish Academy of Sciences, Warsaw.

FROM PROBLEMS OF LOAD CAPACITY OF STEEL CRANE BEAMS [Z ZAGADNIEN NOSNOSCI STALOWYCH BELEK PODSUWNICOWYCH]

Wanda Paprocka-Garlicka 10 Dec. 1975 27 p refs In POLISH

Avail: Issuing Activity

The limital loading of steel crane beams is calculated using the theory of limital load capacity and the theory of adaptation. Results for the two methods are compared. Elasticity of the beam, and elastic deformations are considered. Beams of two to four spans of equal length are loaded with two motion forces. Cross sections are taken at regular intervals along the length of the beams. It is shown that damge to extreme spans decisively influences the values of limital loading. Author

N77-14510 State Univ. of New York, Stony Brook.

DYNAMIC STRESSES DUE TO THE SCATTERING OF ELASTIC WAVES BY SPHERICAL CAVITIES IN AN ELASTIC MEDIUM Ph.D. Thesis

Hsin-Yung Chang 1976 104 p

Avail: Univ. Microfilms Order No. 76-18736

The formal solution is obtained with consideration of multiple-scattering of elastic waves by the spherical cavities. The scheme of multiple scattering used is suggested by Twersky in acoustics and electromagnetics. The dynamic stress concentrations around the spherical cavities are studied. The geometrical configuration of the spherical cavities in the elastic medium is arbitrary. Numerical results of two identical cavities are calculated and discussed in detail. It is found, in this case, the normal stresses are oscillating about the value for a single cavity. And the maximum stress and its location will be changed due to the presence of another cavity. Dissert. Abstr.

N77-14511 Virginia Polytechnic Inst. and State Univ., Blacksburg.

MOVING MASS ON STRUCTURES (BEAM, PLATE, SHELL) Ph.D. Thesis

Ramjee Raghavan 1974 143 p

Avail: Univ. Microfilms Order No. 76-24338

A technique was presented to obtain the solutions of the differential equation of motion, which govern the dynamic response of beams, plates and shells subjected to moving masses. To illustrate the procedure, the particular case of simply supported end conditions was used. The load consists of nonelastic wheel type mass, together with a pulsating driving force. The mass is assumed to move either in an arbitrary linear path with a constant velocity or in a cyclic path with respect to any arbitrary point on the elastic structure. The elastic structure is supported by an elastic foundation, and loaded by a constant axial force, which is not large enough to cause buckling. The finite integral transforms, i.e., sine or cosine, are applied to the partial differential equation of motion, to remove the dependence on the spatial variable. Dissert. Abstr.

N77-14512 Texas Univ., Austin.
THE PERFORMANCE OF LAPPED SPLICES IN REINFORCED CONCRETE UNDER RAPID LOADING Ph.D. Thesis
Telvin Rezansoff 1976 263 p
Avail: Univ. Microfilms Order No. 76-26693

The behavior and strength of lapped reinforcing steel splices under dynamic (impact) loading was measured and compared to the response expected under static loading. It was determined whether strengths and toughnesses were comparable under dynamic and static loading so as to enable the proportioning of dynamically loaded splices using established design criteria for static loading. Loading and specimen features examined in the 20 specimens tested include splice length, use of stirrups through the splice, incrementally increasing impact load levels to failure, repeated loading under fixed impact levels, reversal loading placing the splice into tension and compression on alternate cycles, and influence of top placed concrete on splice strength. Reactions, deflections and steel strains were measured during impact loading. Dissert. Abstr.

N77-14513 Washington Univ., Seattle.
ASSUMED DISPLACEMENT HYBRID FINITE ELEMENT METHOD FOR A FINITE STRAIN ANALYSIS AND ELASTIC-PLASTIC FRACTURE MECHANICS Ph.D. Thesis
John S. Cheng 1976 209 p
Avail: Univ. Microfilms Order No. 76-25394

The first procedure, which employs an incremental tangent modulus method with an equilibrium check, was used to analyze the strain field surrounding an indenter applied to a monkey brain. This strain field was correlated with indications of neuron reaction in the indented brain. The second procedure was used to analyze an edge-cracked three-point bend fracture test specimen under the condition of large-scale yielding. The strongly singular strain field and weakly singular stress field have been embedded in finite elements near the crack tip. Detailed numerical results are presented for load point displacement, load point work, crack opening displacement, plastic yield-zones, effective stresses and strains in the net section ligament and the J-integral. Path independency of the J-integral is indicated in this analysis. Dissert. Abstr.

N77-14514 Oklahoma Univ., Norman.
THE USE OF THERMOGRAPHY IN FATIGUE STUDIES Ph.D. Thesis
John Andrew Charles 1976 289 p
Avail: Univ. Microfilms Order No. 76-24362

Materials undergoing cyclic loading dissipate energy in the form of heat due to hysteresis effects in the material. At the locations of high stress levels, more heat is released than elsewhere, resulting in local temperature rises in those areas. Using the scanning infrared camera, accurate visual images of the surface temperature distributions in the materials being fatigued are obtained. From such images, conclusions are drawn pertaining to the prediction of areas most likely to sustain the greatest fatigue damage during cyclic loading. The extent of the fatigue damage in specimens is also monitored. Using temperature field maps, energy dissipation rates are determined for some specimens. A number of mathematical models are proposed with which to investigate the effects of the various parameters. Some limitations of the technique and possibilities for further study are discussed in light of the results from the models and the experiments. Dissert. Abstr.

N77-14515 National Lending Library for Science and Technology, Boston Spa (England).
FLUID CONCRETE (SUPER-PLASTICIZED CONCRETE)
J. P. A. J. VanderZanden [1976] 17 p Transl. into ENGLISH from Cement (Zagreb, Yugoslavia), v. 27, no. 4, 1975 p 148-155
(NLL-M-24111-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The production and engineering properties of plasticized concrete are discussed. The technological design includes the conversion of concretes with plastic consistency into fluid concrete by adding organic plasticizers, such as calcium lignin sulphonate and sulphonated melamine formaldehyde resin. The development of this product enables the construction industry to reduce the cost of raw materials and improve the consistency and workability of concretes. I.M.

N77-14516# Technische Hogeschool, Delft (Netherlands).
GENERAL THEORY OF MODE INTERACTION IN STIFFENED PLATE AND SHELL STRUCTURES
W. T. Koiter Sep. 1976 44 p refs
(WTHD-91; Rept-590) Avail: NTIS HC A03/MF A01

Mode interaction is an important and often dangerous phenomenon in the buckling of stiffened plate and shell structure with nearly equal critical loads for the long wave overall mode and the short wave local or panel mode. An approximate general theory is derived on the basis of amplitude modulation of the short wave mode due to its interaction with the long wave mode. The method of analysis is a generalization of previous work on mode interaction in stiffened flat plates and built-up columns. The interaction is shown to have always a detrimental effect on the load carrying capacity of the structure, in particular in the presence of unavoidable imperfections. A few numerical examples illustrate the theory, and some recommendations are formulated for a systematic numerical evaluation. Author

N77-14517# Technische Hogeschool, Delft (Netherlands).
ASYMPTOTIC FORMULA FOR THE BUCKLING STRESS OF AXIALLY COMPRESSED CIRCULAR CYLINDRICAL SHELLS WITH MORE OR LESS LOCALIZED SHORT-WAVE IMPERFECTIONS
V. Z. Gristchak Sep. 1976 19 p refs
(WTHD-88) Avail: NTIS HC A02/MF A01

An initial imperfection of a shell may result in a large reduction of the critical load in comparison with the theoretical values found for a perfect shell. Moreover, in such cases there is considerable scatter in the experimental results. This imperfection-sensitivity is particularly marked in the case of cylindrical shells under axial compression. It is less severe for cylindrical shells under external pressure, but on the other hand, spherical shells under external pressure are again very sensitive to imperfections. Asymptotic approximation to imperfection-sensitivity by means of the general nonlinear theory of elastic stability yields significant, reasonably accurate results for imperfections whose magnitude is up to about 20 percent of the shell thickness. The same asymptotic approach is used for more general imperfection shapes. The buckling of an axisymmetric equilibrium configuration into a nonsymmetric shape is discussed. Author

N77-14518*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONSIDERATIONS FOR THE APPLICATION OF FINITE ELEMENT BEAM MODELING TO VIBRATION ANALYSIS OF FLIGHT VEHICLE STRUCTURES Ph.D. Thesis - Case Western Reserve Univ.
Raymond G. Kvaternik Nov. 1976 101 p refs
(NASA-TM-X-73980) Avail: NTIS HC A06/MF A01 CSCL 13M

The manner of representing a flight vehicle structure as an assembly of beam, spring, and rigid-body components for vibration analysis is described. The development is couched in terms of a substructures methodology which is based on the finite-element stiffness method. The particular manner of employing beam, spring, and rigid-body components to model such items as wing structures, external stores, pylons supporting engines or external stores, and sprung masses associated with launch vehicle fuel slosh is described by means of several simple qualitative examples. A detailed numerical example consisting of a tilt-rotor VTOL aircraft is included to provide a unified illustration of the procedure for representing a structure as an equivalent system of beams, springs, and rigid bodies, the manner of forming the substructure mass and stiffness matrices, and the mechanics of writing the equations of constraint which enforce deflection compatibility at the junctions of the substructures. Since many structures, or selected components of structures, can be represented in this manner for vibration analysis, the modeling concepts described and their application in the numerical example shown should prove generally useful to the dynamicist. Author

N77-14519# Royal Aircraft Establishment, Farnborough (England).
A STUDY OF LOCAL STRESS HISTORIES IN LOADED AND

UNLOADED HOLES AND THEIR IMPLICATIONS TO FATIGUE LIFE ESTIMATION

J. E. Moon, B. H. E. Perrett, and P. R. Edwards 8 Jul. 1976 35 p refs

(RAE-TR-76090; BR53900) Avail: NTIS HC A03/MF A01

Local stress measurements in aluminum alloy specimens at open holes and pin-loaded holes of the same elastic stress concentration factor, under variable amplitude loading were presented. The companion specimen method was used and the results were interpreted with particular reference to fatigue life estimation. In addition the Neuber test and linear strain methods were used to make estimates of the local stress history for the case of the open hole. Companion specimen tests with an ascending-descending zero to peak stress sequence showed that there was no significant difference in local stress ranges or residual stresses between an open hole and a pin-loaded hole of the same stress concentration. A comparable Neuber test produced errors in both maximum local strains and residual stresses and ways of improving this method are discussed. Author

N77-14520*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FRACTURE ANALYSIS OF SURFACE AND THROUGH CRACKS IN CYLINDRICAL PRESSURE VESSELS

J. C. Newman, Jr. Washington Dec. 1976 35 p refs

(NASA-TN-D-8325; L-11118) Avail: NTIS HC A03/MF A01 CSCL 13M

A previously developed fracture criterion was applied to fracture data for surface- and through-cracked cylindrical pressure vessels to see how well the criterion can correlate fracture data. Fracture data from the literature on surface cracks in aluminum alloy, steel, and epoxy vessels, and on through cracks in aluminum alloy, titanium alloy steel, and brass vessels were analyzed by using the fracture criterion. The criterion correlated the failure stresses to within + or - 10 percent for either surface or through cracks over a wide range of crack size and vessel diameter. The fracture criterion was also found to correlate failure stresses to within + or - 10 percent for flat plates (center-crack or double-edge-crack tension specimens) and cylindrical pressure vessels containing through cracks. Author

N77-14521# California Univ., Livermore. Lawrence Livermore Lab.

PLANE STRESS CALCULATIONS WITH A TWO DIMENSIONAL ELASTIC-PLASTIC COMPUTER PROGRAM

Mark L. Wilkins and Michael W. Guinan 5 Apr. 1976 16 p refs Presented at Conf. on Computer Simulation for Mater. Appl., Gaithersburg, Md., 19 Apr. 1976

(Contract W-7405-eng-48)

(UCRL-77251; Conf-760421) Avail: NTIS HC A02/MF A01

A method for adapting a two dimensional elastic-plastic computer program to calculate problems in plane stress as well as plane strain geometry is presented. A simulation of a tension test of a flat aluminum plate pulled to failure was calculated with the modified two dimensional program. The results were compared with a fully three dimensional calculation. Finally, a comparison was made with an experiment to demonstrate the effectiveness of the computational methods for studying fracture of work hardening materials. ERA

N77-14522# Brookhaven National Lab., Upton, N.Y.

PIPING DYNAMIC ANALYSIS BY THE SYNTHESIS METHOD

P. Bezler and John R. Curreri (Polytechnic Inst. of N. Y.) 1976 21 p

(BNL-20987; Conf-760339-1) Avail: NTIS HC A02/MF A01

An application of the synthesis method to piping vibrations analyses is demonstrated. Specifically, the technique is illustrated by determining the normal modes and natural frequencies of a composite bend from the normal mode and natural frequency data of two component parts. A comparison of the results to those derived for the composite bend by other techniques is made. ERA

N77-14523# Oak Ridge Y-12 Plant, Tenn.

FAILURE ANALYSIS OF THE SPLIT-D TEST METHOD

C. E. Knight, Jr. Mar. 1976 26 p refs Presented at the 4th Natl. Conf. on Composite Materials: Testing and Design, Valley Forge, Pa., 3-4 May 1976

(Contract W-7405-eng-26)

(Y-DA-6498; Conf-760504-1) Avail: NTIS HC A03/MF A01

The Split D test is used to determine unidirectional tensile strength of filament wound composites but it has a known stress concentration in the ring near the D edge. A finite element stress analysis and a statistical strength theory are used to assess the influence of the stress concentration on the ultimate strengths calculated for the composites from the Split D test. Stress distributions are presented for the conventional Split D ring as well as the elongated ring specimens. The influence of material variability via the Weibull parameter, m, on the predicted failure level is shown. In general, materials with an average variability ($M < 40$) will yield Split D test results above 90 percent of the true strength. ERA

N77-14524# Intertech Corp., Iowa City, Iowa.

OPTIMIZATION OF DISTRIBUTED PARAMETER STRUCTURES UNDER DYNAMIC LOADS Final Technical Report, Feb. - May 1976

T. T. Feng, E. J. Haug, Jr., and J. S. Arora Jun. 1976 39 p refs

(Contract DAAA09-75-C-2019)

(AD-A025368; Rept-25) Avail: NTIS HC A03/MF A01 CSCL 13/13

In this report, optimal design of continuous structural systems under dynamic loads is considered. An optimization technique is developed based on the generalized steepest descent method and optimal control techniques Bryson and Ho. The method is then applied to some beam and plate problems. Author (GRA)

N77-14525# Watervliet Arsenal, N.Y.

FEASIBILITY STUDY OF FILAMENT WOUND COMPOSITE ROAD WHEEL

Giuliano Dandrea, Peter G. OHara, and Paul J. Croteau Jun. 1976 52 p

(DA Proj. 1G6-62601-AH-91)

(AD-A026697; WVT-TR-76020) Avail: NTIS HC A04/MF A01 CSCL 13/13

The feasibility of fabricating a M113 composite road wheel by the filament winding process has been demonstrated. Theoretical results, showing road wheel deformation where subjected to a radial compression load, have been obtained for both the conventional and composite M113 road wheel. Experimental results, for radial compression tests, show correlation between theory and experiment. Concepts for reducing road wheel vulnerability to mine blasts are also presented.

Author (GRA)

N77-14526# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

ROAD FOUNDATIONS: PROBLEMS OF BEARING CAPACITY AND FROST RESISTANCE

D. Bonnard and E. Recordon May 1976 29 p Transl. into ENGLISH from Strasse und Verkehr, (Switzerland), v. 44, Jun. 1958 p 311-318

(AD-A027017; CRREL-TL-524) Avail: NTIS HC A03/MF A01 CSCL 13/2

Problems encountered in the construction of road foundations and principal causes of road failure are summarized, and countermeasures are described on the basis of studies by the Swiss Union of Road Professionals and the Geotechnical Laboratory of Lausanne University. Preliminary survey procedures and the evaluation of data on the frost-susceptibility of soils, their bearing capacity, sensitivity to water, regional hydrological conditions, and freezing depths are discussed. Design specifications are given for foundations for flexible and rigid pavements in frost-susceptible soils, and data are tabulated and graphed.

GRA

N77-14527# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

EFFECT OF SUBZERO TEMPERATURE IN CONCRETE ON THE NATURE OF OPERATIONS OF HIGH CONCRETE DAMS

V. N. Durcheva Jun. 1976 11 p Transl. into ENGLISH from Gidrotekhn. Stroit, (USSR), no. 3, Mar. 1973 p 26-29

(AD-A027016; CRREL-TL-531) Avail: NTIS HC A02/MF A01 CSCL 13/2

The experimental and full scale studies of the properties of frozen concrete conducted by the author have made it possible to recommend empirical relationships for determining the linear expansion coefficient. GRA

N77-14528# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

CONCRETE PLACING TECHNIQUES USED DURING THE CONSTRUCTION OF THE KASNOYARSK HYDROELECTRIC POWER PLANT

E. A. Dolginin Jul. 1976 17 p Transl. into ENGLISH from Gidrotekhn. Stroit., (USSR), no. 9, Sep. 1972 p 19-23
(AD-A026967; CRREL-TL-534) Avail: NTIS HC A02/MF A01 CSCL 13/2

The concrete Krasnoyarsk hydroelectric station dam, at its highest point 124 meters high, is approximately 1100 meters long and is located in a relatively narrow rocky canyon of the Yenesey River. The amount of concrete in the dam and hydroelectric station building is 5.5 million cubic meters. The concrete operations were accomplished under severe climatic conditions - the frost-free period was 102 days long and temperature ranged from -54 to 37C. Great requirements were levied on the concrete with regard to strength, imperviousness to water, cavitation resistance, cold resistance and fracturing resistance. This report discusses the construction problems and considerations. GRA

N77-14529# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

THE INFLUENCE OF INSULATION UPON FROST PENETRATION BENEATH PAVEMENTS

Robert A. Eaton and Daniel E. Dukeshire May 1976 49 p refs
(DA Proj. 4K0-78012-AAM-1)
(AD-A026957; CRREL-SR-76-6) Avail: NTIS HC A03/MF A01 CSCL 13/2

Frost action in soils causes pavement structures to heave because of ice lense growth during the freezing season. The loss of structural support in the spring caused by melting of the ice lenses can precipitate pavement failure. In order to minimize differential frost heaving caused by variable in-situ soil conditions, granular material is placed on top of the frost-susceptible subgrade. This creates a uniform layer to bridge subsurface irregularities in soil properties. The thickness of uniform granular material depends on the depth of frost penetration and desired protection. This method of protecting the pavement structure from differential (uneven) heaving can be costly depending on the amount of granular material required and its availability. A method of reducing the amount of granular material is the use of a thermal insulating layer beneath all or part of the base course which prevents freezing temperatures from reaching the non-uniform subgrade. A test road which includes Styrofoam board insulated test sections was constructed at CRREL in 1973. GRA

N77-14530# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

EVALUATION OF NONLINEAR RESILIENT MODULI OF UNBOUND GRANULAR MATERIALS FROM ACCELERATED TRAFFIC TEST DATA Final Report

Yu. T. Chou Aug. 1976 56 p refs Sponsored in part by the Chief of Engineers (Army)
(Contract DOT-FA73WAI-377)
(AD-A030377/6; FAA-RD-76-65) Avail: NTIS HC A04/MF A01 CSCL 13/3

A method for evaluating the resilient moduli of unbound granular materials is presented. The moduli were back-calculated from correlations of performance data of numerous full-scale accelerated traffic test pavements with computed critical stresses and strains of test pavements. The test pavements consisted of conventional flexible pavements as well as all bituminous concrete (ABC) pavements. The stresses and strains in the pavement structures were computed by the finite element technique incorporated with the tried nonlinear stress-strain relations of pavement materials. A general discussion on the nonlinear characteristics of pavement materials and limitations of the finite element computer program is presented. The principle of superposition was used in the computations for multiple-wheel load assemblies. Stresses and deflections computed by the nonlinear-finite element method as compared with actual measurements of stress and deflection for a full-scale flexible test pavement are given. The nonlinear resilient moduli used in the computations were evaluated from traffic test data presented. The nonlinear characteristics of pavement materials under loads are discussed. It is recommended that the nonlinear resilient moduli presented be used to compute pavement responses when laboratory repeated load test data on granular materials are not available. Author

N77-14531# Massachusetts Univ., Amherst. Dept. of Civil Engineering.

VIBRATIONS OF THIN ELASTIC SHELLS: A NEW APPROACH Interim Report

M. J. Callaghan, W. A. Nash, and P. M. Quinlan Aug. 1975 112 p refs
(Grant AF-AFOSR-2340-72; AF Proj. 9782)
(AD-A027706; AFOSR-76-0731TR) Avail: NTIS HC A06/MF A01 CSCL 20/11

A previous investigation by one of the present authors extended the method of Edge-Functions to the determination of natural frequencies and associated mode shapes of free vibration of thin elastic plates with a variety of boundary conditions. The present investigation further extends this approach to the case of a shallow elastic spherical shell of n-sided polygonal plan-form. Natural frequencies and associated mode shapes together with boundary residuals (indicating how well the approximate solution has satisfied boundary conditions) are readily displayed by the computer program offered. Results obtained in the present work are shown to be in excellent agreement with existing values for specific boundary conditions treated. The present approach involves only modest computer efforts but offers the significant feature of rapid determination of how precisely the boundary conditions have been satisfied along each edge of the shell. GRA

N77-14532# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

SURFACE CHARACTERIZATION OF HONEYCOMB CORE MATERIALS Final Report, Sep. 1975 - Jan. 1976

William L. Baun, Neil J. McDevitt, and James S. Solomon Mar. 1976 62 p refs
(AF Proj. 7340)
(AD-A026172; AFML-TR-76-18) Avail: NTIS HC A04/MF A01 CSCL 13/13

Surface characterization studies are carried out on honeycomb core materials by Auger Electron Spectroscopy (AES), Secondary Ion Mass Spectroscopy (SIMS), Ion Scattering Spectroscopy (ISS), and Secondary Electron Microscopy (SEM). Core materials which were studied included 5052, 5056, and 2024 aluminum alloys, titanium, c.p., titanium - 6 aluminum - 4 vanadium and stainless steels. Effects of thermal segregation and chemical treatments were studied. Author (GRA)

N77-14533# Watervliet Arsenal, N.Y. Benet Weapons Lab.

APPLICATION OF SIMILARITY PRINCIPLE TO DYNAMIC CRACK PROBLEMS IN ANTI-PLANE STRAIN

R. L. Ryan May 1976 46 p refs
(DA Proj. 1F1-61102-AH-45)
(AD-A026698; WVT-TR-76022) Avail: NTIS HC A03/MF A01 CSCL 20/11

This report presents an alternative method whereby the anti-plane strain equations of elastodynamics, for which the boundary conditions are of mixed type, may be integrated. The method exploits the similarity property of the solution through the use of integral transforms together with Riemann-Hilbert theory. As an application, the transient stress field around a semi-infinite crack is obtained for a homogeneous material and for a bimaterial; the dynamic stress concentration factor for each case is extracted. Author (GRA)

N77-14534# Massachusetts Inst. of Tech., Cambridge. Constructed Facilities Div.

STUDIES ON THE INELASTIC DYNAMIC ANALYSIS AND DESIGN OF MULTI-STORY FRAMES Report, Sep. 1975 - Jul. 1976

William Harrison Luyties, III, Stavros Aristidou Anagnostopoulos,

and John M. Riggs Jul. 1976 197 p refs
(Grant NSF ATA-74-06935)
(PB-256540/6; R76-29; Ropt-6) Avail: NTIS HC A09/MF A01 CSCL 13M

The inelastic dynamic response of plain frames subjected to earthquake loadings is studied. A sophisticated computer program is used for the time integration of the nonlinear equations of motion. First, two models of nonlinear member behavior are compared: the single and the dual component model. Both have been used in the past in nonlinear dynamic analysis studies. Then two real buildings are analyzed for an artificial motion matching the design spectrum. GRA

N77-14535# Science Applications, Inc., Oakland, Calif.
STEALTH: A LANGUAGE EXPLICIT FINITE-DIFFERENCE CODE FOR SOLIDS STRUCTURAL AND THERMOHYDRAULIC ANALYSIS
Ronald Hofmann Jun. 1976 84 p refs
(EPRI Proj. 307)
(PB-255405/3; EPRI-NP-176; TR-1) Avail: NTIS HC A05/MF A01 CSCL 18I

A useful computer simulation method based on the explicit finite difference technique can be used to address transient dynamic situations associated with nuclear reactor design and analysis. An introduction to explicit finite difference technology, the theoretical background (physical and numerical), a review of some explicit codes, and a discussion of nuclear reactor applications are included along with and a brief description of EPRI's STEALTH codes. The STEALTH codes are based entirely on the published technology of the Lawrence Livermore Laboratory (LLL). Livermore, California, and Sandia Laboratories, Albuquerque, New Mexico. GRA

N77-14536# Sydney Univ. (Australia). Civil Engineering Labs.
CRACKING IN CONCRETE: ATTRIBUTED TO DEFECTS IN DESIGN
D. Campbell-Allen and R. G. Smith Apr. 1976 121 p refs (PB-256431/8; R-286) Avail: NTIS HC A06/MF A01 CSCL 13C

As part of a project aimed at reducing cracking in concrete, a number of cases of cracking have been examined where the defects could be attributed mainly to inadequacies of design or lack of liaison between the design and construction. Fourteen case studies are presented describing some twenty cracking incidents. GRA

N77-14537# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
INTERPRETATION OF THE TENSILE STRENGTH OF ICE UNDER TRIAXIAL STRESSES
Donald E. Nevel and F. Donald Haynes Apr. 1976 15 p refs (AD-A027042; CRREL-76-5) Avail: NTIS HC A02/MF A01 CSCL 08/12

Griffith, and later Babel, have previously developed a tensile fracture criterion for a two-dimensional state of stress. This theory is extended to the compression-compression region. From this theory the angle of fracture is developed. The theory is extended conceptually to three dimensions. Triaxial test data by Haynes for snow-ice are shown in this three-dimensional fracture theory. The test data are slightly less than those predicted when the void in the snow-ice is spherical. Author (GRA)

N77-14538 State Univ. of New York, Buffalo.
NON-LINEAR THREE DIMENSIONAL BUCKLING AND POSTBUCKLING BEHAVIOR OF PRESTRESSED ARCHES AND LARGE PRESTRESSED DOMES Ph.D. Thesis
Amde Meskel Wolde-Tinsae 1976 204 p
Avail: Univ. Microfilms Order No. 76-26577

A system of non linear differential equations for the study of two and three dimensional elastic problems is presented. Several algorithms based on a shooting method are developed and utilized to shed some light on finite deformations, buckling and postbuckling behavior of prestressed arches in three dimensions. The convergence properties of algorithms proposed for studying the behavior of prestressed domes are investigated; and numerical difficulties encountered in applying algorithms based on a shooting method to problems with four missing initial conditions are reported. Dissert. Abstr.

42 GEOSCIENCES (GENERAL)

N77-14539*# EG and G Washington Analytical Services Center, Inc., Rockville, Md.
SEDIMENT MEASUREMENT IN ESTUARINE AND COASTAL AREAS
Philip E. Shelley Washington NASA Dec. 1976 102 p refs (Contract NAS6-2325)
(NASA-CR-2769; TR-7115-001) Avail: NTIS HC A06/MF A01 CSCL 08J

A survey of uses of estuarine and coastal areas is given. Problems associated with these uses are discussed, and data needs for intelligent management of these valuable areas are outlined. Suspended sediment measurements are seen to be one of the greatest needs. To help understand the complexity of the problem, a brief discussion of sediment mechanics is given, including sediment sources, characteristics, and transport. The impact of sediment mechanics on its direct measurement (sampling and analysis) is indicated, along with recommendations for directly obtaining representative data. Indirect measurement of suspended sediment by remote sensors is discussed both theoretically and in the light of some recent experiences. The need for an integrated, multidisciplinary program to solve the problem of quantitatively measuring suspended sediment with remote sensors is stressed, and several important considerations of such a program and benefits to be derived therefrom are briefly addressed. Author

N77-14540*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CALTECH/JPL CONFERENCE ON IMAGE PROCESSING TECHNOLOGY, DATA SOURCES AND SOFTWARE FOR COMMERCIAL AND SCIENTIFIC APPLICATIONS
Gunther H. Redmann 1976 189 p refs Proc. held at Pasadena, Calif., 3-5 Nov. 1976
(Contract NAS7-100)
(NASA-CR-149343; JPL-SP-43-30) Avail: NTIS HC A09/MF A01 CSCL 08G

Recent advances in image processing and new applications are presented to the user community to stimulate the development and transfer of this technology to industrial and commercial applications. The Proceedings contains 37 papers and abstracts, including many illustrations (some in color) and provides a single reference source for the user community regarding the ordering and obtaining of NASA-developed image-processing software and science data. Author

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N77-14541 Pennsylvania State Univ., University Park.
INORGANIC AND ISOTOPIC GEOCHEMISTRY OF THE UNSATURATED ZONE IN A CARBONATE TERRANE Ph.D. Thesis
Stephen OReilly Sears 1976 244 p
Avail: Univ. Microfilms Order No. 76-24799

The influence of processes in the unsaturated zone (zone of aeration) on the quality of ground water recharge, and resultant ground water is studied. Soil moisture samples were collected from depths of 1-9 m in the unsaturated zone with suction lysimeters. The three sites studied were in a carbonate rock terrane in central Pennsylvania. General results of the study indicate that: (1) weathering of carbonate rocks in the unsaturated zone not only involves their attack by carbonic acid derived from soil CO2, but that other sources of acidity such as H(+)

desorbed from clays and oxidation of pyrite can be important; (2) in mineralogically and texturally homogeneous soils, Donnan equilibrium effects and selective adsorption are capable of maintaining constant major cation ratios in the soil solution over extended periods of time; (3) solubilities of ideal clay minerals used in conjunction with analyses of water chemistry and soil clay mineralogy can be used to determine the direction of clay diagenesis in soils; (4) a small fraction of the soil water moves downward rapidly, in contrast to the major portion of the total soil moisture which is practically stationary. Dissert. Abstr.

N77-14542*# Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).
[LANDSAT DATA UNDER TYPICAL EUROPEAN ENVIRONMENTAL FRAME CONDITIONS] Progress Report, 9 Sep. 1975 - 9 Sep. 1976
J. Bodechtel, Principal Investigator 9 Sep. 1976 3 p Sponsored by NASA ERTS
(E77-10031; NASA-CR-149096; PR-1) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N77-14543*# Geological Survey, Malaysia.
GEOLOGICAL AND HYDROGEOLOGICAL INVESTIGATIONS IN WEST MALAYSIA Quarterly Report
Jaafar Bin Ahmad, Principal Investigator Aug. 1976 5 p Sponsored by NASA ERTS
(E77-10033; NASA-CR-149134; QR-1) Avail: NTIS HC A02/MF A01 CSCL 08G

There are no author-identified significant results in this report.

N77-14544*# Pakistan Water and Power Development Authority, Lahore.
WATER RESOURCES INVESTIGATION IN WEST PAKISTAN WITH THE HELP OF ERTS IMAGERY: SNOW SURVEYS
Ch. Mohammad Umar, Principal Investigator Aug. 1976 48 p Sponsored by NASA ERTS
(E77-10038; NASA-CR-149139; Rept-29810) Avail: NTIS HC A03/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N77-14545*# Department of Industry, London (England).
THE USE OF ERTS/LANDSAT IMAGERY IN RELATION TO AIRBORNE REMOTE SENSING FOR TERRAIN ANALYSIS IN WESTERN QUEENSLAND, AUSTRALIA Quarterly Report
Monica M. Cole, Principal Investigator and Stewart Owen-Jones 15 Nov. 1976 9 p refs Sponsored by NASA ERTS
(E77-10046; NASA-CR-149252) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. Distinctive spectral signatures were found associated with areas of near surface bedrock with covered ground east of Dugald River and along the Thorntonia River valley west of Lady Annie. Linears identified in the Dugald River area on LANDSAT 2 imagery taken in March and July 1975 over the Cloncurry-Dobbyn area, displayed preferred orientation. A linear group with NE-SW orientation was identified in the Lady Annie area. In this area, the copper mineralization in the Mt. Kelly area occurs along a well marked linear with NNW/SSE direction apparent on images for March, September, and November 1975. Geobotanical anomalies provided surface expression of the copper deposits in Mt. Kelley.

N77-14546*# Geological Survey, Reston, Va.
DETECTION AND MAPPING OF MINERALIZED AREAS IN THE CORTEZ-UINTA BELT, UTAH-NEVADA USING COMPUTER-ENHANCED ERTS IMAGERY Progress Report
Lawrence C. Rowan, Principal Investigator, Alexander F. H. Goetz (JPL), and Roger P. Ashley [1976] 2 p Sponsored by NASA ERTS
(E77-10047; NASA-CR-149253) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. The reflectance spectra of most hydrothermally altered rocks were characterized by broad ferric iron absorption bands short of 1.1 microns and a sharper hydroxyl band near 2.2 microns; maximum reflectance occurred near 1.6 microns. Their features became more prominent as albedo increased. The MSS color ratio composite images were the most effective and practical means for detecting and mapping limonitic rocks in areas having less than about 50 percent desert brush cover and less than 25-35 percent coniferous tree cover. Limonitic altered and unaltered rocks could not be distinguished in MSS color ratio composite images.

N77-14547*# New England Univ., Armidale (Australia).
STRUCTURES IN GRANITIC BATHYLITHS AND ASSOCIATED FOLDBELTS IN RELATION TO MINERAL RESOURCES Quarterly Report
Hilary J. Harrington, Principal Investigator and Kerry L. Burns (Commonwealth Scientific and Industrial Res. Organization, North Ryde, Australia) 28 Oct. 1976 5 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10048; NASA-CR-149255; QR-1) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N77-14548*# Corps of Engineers, Waltham, Mass.
THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Progress Report, period ending 1 Sep. 1976
Saul Cooper, Principal Investigator 1 Sep. 1976 13 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10049; NASA-CR-149256) Avail: NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results. A graph that shows the snow water equivalent data during the 1975-76 winter season for the Ninemile and Michaud Farms snow pillows located in northern Maine is shown. The Bournes transducers used in the snow pillow interface were tested after field use under controlled laboratory conditions of temperature and pressure. It was found that the temperature calibration curve for the Bournes transducers became erratic below 0 C. On 8-10 August 1976, the remainder of hurricane, Belle, travelled through Vermont, New Hampshire, northern Maine, and on into Canada's Maritime Provinces dumping three inches of rain in many areas. In Canada and Maine, local storms dropped up to two inches during the following week. The Saint John River reached near flood stages at Fort Kent, Maine. During this storm, DCP data were received from Fort Kent, Ninemile Bridge, and Saint Francis River in New Brunswick. Resulting high runoff after these storms was studied in connection with the proposed Dickey-Lincoln School dams to be built in that area, and significantly, it was found that creditable flood hydrographs could be generated from LANDSAT DCP data in spite of the voids caused by the satellite being below the horizon.

N77-14549*# West Virginia Dept. of Natural Resources, Charleston.
CONTRIBUTION OF ERTS-B TO NATURAL RESOURCE PROTECTION AND RECREATIONAL DEVELOPMENT IN WEST VIRGINIA Progress Report, 19 Jun. - 19 Sep. 1976
Ira S. Latimer, Jr., Principal Investigator 16 Nov. 1976 12 p refs ERTS
(E77-10050; NASA-CR-149257; PR-4) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N77-14550*# Stanford Univ., Calif. School of Earth Sciences.
EVALUATION OF ERTS MULTISPECTRAL SIGNATURES IN RELATION TO GROUND CONTROL SIGNATURES USING A NESTED-SAMPLING APPROACH Final Report
Ronald J. P. Lyon, Principal Investigator Apr. 1975 275 p refs Revised Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota

Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21884)
(E77-10051; NASA-CR-149258) Avail: NTIS HC A12/MF A01 CSCL 08F

The author has identified the following significant results. Ground measured spectral signatures of wavelength bands matching ERTS MSS were collected using a radiometer at several Californian and Nevadan sites, and directly compared with similar data from ERTS CCTs. The comparison was tested at the highest possible spatial resolution for ERTS, using deconvoluted MSS data, and contrasted with that of ground measured spectra, originally from 1 meter squares. In the mobile traverses of the grassland sites, these one meter fields of view were integrated into eighty meter transects along the five km track across four major rock/soil types. Suitable software was developed to read the MSS CCT tapes, to shadeprint individual bands with user-determined greyscale stretching. Four new algorithms for unsupervised and supervised, normalized and unnormalized clustering were developed, into a program termed STANSORT. Parallel software allowed the field data to be calibrated, and by using concurrently continuously collected, upward- and downward-viewing, 4 band radiometers, bidirectional reflectances could be calculated.

N77-14551*# Montana Univ., Missoula. Dept. of Geology.
APPLICABILITY OF ERTS-1 TO MONTANA GEOLOGY Final Report
R. M. Weidman, Principal Investigator, D. D. Alt, R. Berg, W. Johns, R. Flood, K. Hawley, and L. Wackwitz 8 Dec. 1976 92 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21826)
(E77-10052; NASA-CR-149259) Avail: NTIS HC A05/MF A01 CSCL 08G

The author has identified the following significant results. Late autumn imagery provides the advantages of topographic shadow enhancement and low cloud cover. Mapping of rock units was done locally with good results for alluvium, basin fill, volcanics, inclined Paleozoic and Mesozoic beds, and host strata of bentonite beds. Folds, intrusive domes, and even dip directions were mapped where differential erosion was significant. However, mapping was not possible for belt strata, was difficult for granite, and was hindered by conifers compared to grass cover. Expansion of local mapping required geologic control and encountered significant areas unmappable from ERTS imagery. Annotation of lineaments provided much new geologic data. By extrapolating test site comparisons, it is inferred that 27 percent of some 1200 lineaments mapped from western Montana represent unknown faults. The remainder appear to be localized mainly by undiscovered faults and sets of minor faults or joints.

N77-14552*# Norsk Polarinstitutt, Oslo.
SEA ICE STUDIES IN THE SPITSBERGEN-GREENLAND AREA Quarterly Report
Torgny E. Vinje, Principal Investigator Nov. 1976 16 p ref Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10053; NASA-CR-149261; QR-5) Avail: NTIS HC A02/MF A01 CSCL 08L

The author has identified the following significant results. Detailed information on the outflow through the Fram Strait of ice from the Polar Ocean over shorter periods was obtained. It is found that the speed of the outflow may vary about 100% over periods of a few days. The core of the East Greenland Current is found between 2 deg E and 4 deg W. The speed of the surface water at 81 deg N is for a calm period estimated to be about 10 cm/s. A new surging glacier was discovered and new fronts of several glaciers were determined. The variation of the snow line with respect to distance from the coast was for the first time determined for the southern part of Spitsbergen. Great variations were observed, from 200 m in east to 550 m in the central area of the island.

N77-14553*# Alaska Univ., Fairbanks. Cooperative Wildlife Research Unit.
USE OF LANDSAT IMAGERY FOR WILDLIFE HABITAT MAPPING IN NORTHEAST AND EASTCENTRAL ALASKA Final Report, Jun. 1975 - Dec. 1976
Arthur J. L. LaPerriere, III, Principal Investigator 5 Dec. 1976 54 p refs ERTS
(Contract NAS5-20915)
(E77-10054; NASA-CR-149262) Avail: NTIS HC A04/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N77-14554*# Helsinki Univ. (Finland). Dept. of Geology.
INVESTIGATION OF LANDSAT IMAGERY ON CORRELATIONS BETWEEN ORE DEPOSITS AND MAJOR SHIELD STRUCTURES IN FINLAND Quarterly Progress Report, Apr. - Jun. 1976
Heikki V. Tuominen, Principal Investigator and Viljo Kuosmanen [1976] 14 p ref Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10055; NASA-CR-149273; QPR-4) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. Based on tests, it is obvious that practically all major LANDSAT winter linears found are geologically significant features. Most of them are chains of bogs, lakes, rivers, and cultivated areas covered by ice and/or snow, i.e., unforested linear topographic lows. They need no explanation other than that they are extensive fracture zones of the basement.

N77-14555*# Nevada Univ., Reno. Mackay School of Mines.
GEOLOGIC INVESTIGATIONS IN THE BASIN AND RANGE OF NEVADA USING SKYLAB/EREP DATA Final Report
Jack G. Quade, Principal Investigator and Dennis T. Trexler Jun. 1975 169 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13274)
(E77-10056; NASA-CR-144497) Avail: NTIS HC A08/MF A01 CSCL 08B

The author has identified the following significant results. Working from the S190A photography at a scale of 1:702,000 and comparing the results with existing geologic maps has suggested that the larger scale structural features can be mapped and related to regional trends which provide an overall view not available at lower altitudes. All S190B in-house coverage was in stereo. The stereo capability was helpful in resolving problems relating to elevations and attitude of bedding, etc., but the greatest single contribution was the resolution capability.

N77-14556*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
INVESTIGATION OF LANDSAT FOLLOW-ON THEMATIC MAPPER SPATIAL, RADIOMETRIC AND SPECTRAL RESOLUTION Final Report, Nov. 1975 - Apr. 1976
Richard F. Nalepka, Principal Investigator, James P. Morgenstern, Edward R. Kent, and Jon D. Erickson Apr. 1976 228 p refs EREP
(Contract NAS9-14819)
(E77-10057; NASA-CR-150943; ERIM-119300-10-F) Avail: NTIS HC A11/MF A01 CSCL 08B

The author has identified the following significant results. Fine resolution M7 multispectral scanner data collected during the Corn Blight Watch Experiment in 1971 served as the basis for this study. Different locations and times of year were studied. Definite improvement using 30-40 meter spatial resolution over present LANDSAT 1 resolution and over 50-60 meter resolution was observed, using crop area mensuration as the measure. Simulation studies carried out to extrapolate the empirical results to a range of field size distributions confirmed this effect, showing the improvement to be most pronounced for field sizes of 1-4 hectares. Radiometric sensitivity study showed significant degradation of crop classification accuracy immediately upon relaxation from the nominally specified values of 0.5% noise equivalent reflectance. This was especially the case for data which were spectrally similar such as that collected early in the growing

season and also when attempting to accomplish crop stress detection.

N77-14557*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
FOREST CLASSIFICATION ACCURACY AS INFLUENCED BY MULTISPECTRAL SCANNER SPATIAL RESOLUTION Final Report, 15 May 1975 - 14 May 1976
Richard F. Nalepka, Principal Investigator, F. Sadowski, and J. Sarno May 1976 130 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-14123)
(E77-10058; NASA-CR-150998; ERIM-109600-71-F) Avail: NTIS HC A07/MF A01 CSCL 02F

The author has identified the following significant results. A supervised classification within two separate ground areas of the Sam Houston National Forest was carried out for two sq meters spatial resolution MSS data. Data were progressively coarsened to simulate five additional cases of spatial resolution ranging up to 64 sq meters. Similar processing and analysis of all spatial resolutions enabled evaluations of the effect of spatial resolution on classification accuracy for various levels of detail and the effects on area proportion estimation for very general forest features. For very coarse resolutions, a subset of spectral channels which simulated the proposed thematic mapper channels was used to study classification accuracy.

N77-14558*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
INVESTIGATION OF SPATIAL MISREGISTRATION EFFECTS IN MULTISPECTRAL SCANNER DATA Final Report, 15 May 1975 - 14 May 1976
Richard F. Nalepka, Principal Investigator, W. A. Malila, J. M. Gleason, and R. C. Cicone May 1976 79 p refs EREP
(Contract NAS9-14123)
(E77-10059; NASA-CR-150999; ERIM-109600-68-F) Avail: NTIS HC A05/MF A01 CSCL 02F

The author has identified the following significant results. A model for estimating the expected proportion of multiclass pixels in a scene was generalized and extended to include misregistration effects. Another substantial effort was the development of a simulation model to generate signatures to represent the distributions of signals from misregistered multiclass pixels, based on single class signatures. Spatial misregistration causes an increase in the proportion of multiclass pixels in a scene and a decorrelation between signals in misregistered data channels. The multiclass pixel proportion estimation model indicated that this proportion is strongly dependent on the pixel perimeter and on the ratio of the total perimeter of the fields in the scene to the area of the scene. Test results indicated that expected values computed with this model were similar to empirical measurements made of this proportion in four LACIE data segments.

N77-14559*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
EVALUATION OF ALGORITHMS FOR ESTIMATING WHEAT ACREAGE FROM MULTISPECTRAL SCANNER DATA Final Report, 15 May 1975 - 14 May 1976
Richard F. Nalepka, Principal Investigator, Wyman Richardson, and Alex P. Pentland May 1976 100 p refs EREP
(Contract NAS9-14123)
(E77-10060; NASA-CR-151000; ERIM-109600-69-F) Avail: NTIS HC A05/MF A01 CSCL 02C

The author has identified the following significant results. Fourteen different classification algorithms were tested for their ability to estimate the proportion of wheat in an area. For some algorithms, accuracy of classification in field centers was observed. The data base consisted of ground truth and LANDSAT data from 55 sections (1 x 1 mile) from five LACIE intensive test sites in Kansas and Texas. Signatures obtained from training fields selected at random from the ground truth were generally representative of the data distribution patterns. LIMMIX, an algorithm that chooses a pure signature when the data point is close enough to a signature mean and otherwise chooses the best mixture of a pair of signatures, reduced the average absolute error to 6.1% and the bias to 1.0%. QRULE run with a null test achieved a similar reduction.

N77-14560*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
SIGNATURE EXTENSION USING TRANSFORMED CLUSTER STATISTICS AND RELATED TECHNIQUES Final Report, 15 May 1975 - 14 May 1976
Richard F. Nalepka, Principal Investigator, P. F. Lambeck, and D. P. Rice May 1976 79 p refs EREP
(Contract NAS9-14123)
(E77-10061; NASA-CR-151001; ERIM-109600-70-F) Avail: NTIS HC A05/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N77-14561*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
SYSTEM FOR ANALYSIS OF LANDSAT AGRICULTURAL DATA: AUTOMATIC COMPUTER-ASSISTED PROPORTION ESTIMATION OF LOCAL AREAS Final Report, 15 May 1975 - 14 May 1976
Richard F. Nalepka, Principal Investigator, R. J. Kauth, and G. S. Thomas May 1976 102 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-14123)
(E77-10062; NASA-CR-151002; ERIM-109600-67-F) Avail: NTIS HC A06/MF A01 CSCL 02C

The author has identified the following significant results. A conceptual man machine system framework was created for a large scale agricultural remote sensing system. The system is based on and can grow out of the local recognition mode of LACIE, through a gradual transition wherein computer support functions supplement and replace AI functions. Local proportion estimation functions are broken into two broad classes: (1) organization of the data within the sample segment; and (2) identification of the fields or groups of fields in the sample segment.

N77-14562*# Geological Survey, Reston, Va.
AN EXPERIMENT IN CULTURAL INTERPRETATION AND MAP REVISION FROM SKYLAB DATA Final Report
William J. Kosco, Principal Investigator 17 Mar. 1976 25 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4108-B)
(E77-10063; NASA-CR-151105) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N77-14563*# Mekong Committee Secretariat, Bangkok (Thailand).
AGRICULTURE/FORESTRY HYDROLOGY Quarterly Report, Sep. - Nov. 1976
W. J. VanderOord, Principal Investigator Nov. 1976 40 p Sponsored by NASA ERTS
(E77-10064; NASA-CR-149263) Avail: NTIS HC A03/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N77-14564*# Kanner (Leo) Associates, Redwood City, Calif.
APPLICATION OF A SET OF MULTIZONAL SCANNING SPACE IMAGES OF THE EARTH FOR THE STUDY OF GEOLOGICAL STRUCTURE (EASTERN REGIONS OF THE FERGAN AND THE TADZHIK DEPRESSION AS EXAMPLES)
V. M. Panin and S. F. Skobelev Washington NASA Mar. 1976 16 p refs Transl. into ENGLISH of the report "Primeneniye kompleksa mnogozonal nykh skanernykh kosmicheskikh izobrazheniy zemli dlya izucheniya geologicheskoy struktury (na primere vostochnykh rayonov fergana i tadzhikskoy depressii)", Moscow, Acad. of Scis. USSR, 1975 8 p
(Contract NASw-2790)

(NASA-TT-F-16939) Avail: NTIS HC A02/MF A01 CSCL 08G

ERTS-1 multizonal scanning photographs of the eastern Fergan, northeastern Tadzhik Depression and the Pamir-Tien-Shan connecting zone are discussed. The youngest Quaternary formations are best distinguished in the yellow-green spectrum, which also reveals horizons of more ancient rocks with increased groundwater filtration and can be used in hydrogeological exploration. The yellow-red spectrum produces more information on plutonic structure, and the red and infrared bands have much information on both the surface structure and the plutonic structure. Author

N77-14565*# Environmental Research Inst. of Michigan, Ann Arbor.

[REMOTE SENSING OF WETLANDS, MARSHES, AND SHORELINES IN MICHIGAN INCLUDING ST. JOHN'S MARSH] Semiannual Status Report, 1 Jun. - 1 Dec. 1976

Donald S. Lowe 1 Dec. 1976 26 p

(Grant NGR-23-005-552)

(NASA-CR-149348; ERIM-193400-15-L) Avail: NTIS HC A03/MF A01 CSCL 08B

Remote sensing data are used to show the strategic relationship of the endangered marsh to population centers of SE Michigan. The potential ecological consequences and the impact of past development and changing lake levels are discussed. Applications of remote sensing are presented showing its usefulness for preparing statewide infrared wetland and forest mapping. M.C.F.

N77-14566*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

FIRST CONCEPT FOR A TROPICAL AREA MONITORING PROJECT

Jul. 1976 26 p refs

(NASA-TM-X-74306; JSC-11464) Avail: NTIS HC A03/MF A01 CSCL 05B

The first concept of a tropical area monitoring project is presented. The project would develop an operational system capable of monitoring land areas by machine processing of satellite data. LANDSAT images would be processed within a controlled isolable unit to detect changes in forest cover, rangeland, soil integrity, and other factors important to conservation of tropical ecology. An introductory developmental effort is described to demonstrate the use of LANDSAT data in this application. The independent unit, which functions as a user organization within the development project, assures that the technology will be transferable to a user organization through well defined, easily monitored interfaces with the rest of the world. Author

N77-14567*# Earth Satellite Corp., Washington, D.C.

AOIPS WATER RESOURCES DATA MANAGEMENT SYSTEM Final Report, Dec. 1975 - Aug. 1976

Earl S. Merritt, Robert L. Shotwell, Michael C. Place, and Nathaniel J. Belknap Sep. 1976 535 p refs

(Contract NAS5-22894)

(NASA-CR-144823) Avail: NTIS HC A15/MF A01 CSCL 08H

A geocoded data management system applicable for hydrological applications was designed to demonstrate the utility of the Atmospheric and Oceanographic Information Processing System (AOIPS) for hydrological applications. Within that context, the geocoded hydrology data management system was designed to take advantage of the interactive capability of the AOIPS hardware. Portions of the Water Resource Data Management System which best demonstrate the interactive nature of the hydrology data management system were implemented on the AOIPS. A hydrological case study was prepared using all data supplied for the Bear River watershed located in northwest Utah, southeast Idaho, and western Wyoming. Author

N77-14568*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

GEOLOGIC GUIDE TO THE ISLAND OF HAWAII: A FIELD GUIDE FOR COMPARATIVE PLANETARY GEOLOGY

Ronald Greeley, ed. Aug. 1974 258 p refs Prepared in cooperation with Santa Clara Univ., Calif.

(NASA-TM-X-74272) Avail: NTIS HC A12/MF A01 CSCL 08B

With geological data available for all inner planets except Venus, we are entering an era of true comparative planetary geology, when knowledge of the differences and similarities for classes of structures (e.g., shield volcanoes) will lead to a better understanding of general geological processes, regardless of planet. Thus, it is imperative that planetologists, particularly those involved in geological mapping and surface feature analysis for terrestrial planets, be familiar with volcanic terrain in terms of its origin, structure, and morphology. One means of gaining this experience is through field trips in volcanic terrains - hence, the Planetology Conference in Hawaii. In addition, discussions with volcanologists at the conference provide an important basis for establishing communications between the two fields that will facilitate comparative studies as more data become available. Author

N77-14569*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

TROPHIC CLASSIFICATION OF LAKES USING LANDSAT-1 (ERTS-1) MULTISPECTRAL SCANNER DATA Final Report, 1972-1973

D. H. P. Boland Apr. 1976 263 p refs Prepared in cooperation with Pacific Northwest Environmental Research Lab., Corvallis, Ore.

(Contracts NAS7-100; JPL-EZ-608770)

(NASA-CR-149349; PB-255292/5; EPA-600/3-76-037) Avail: NTIS HC A12/MF A01 CSCL 08H

The LANDSAT-1 multispectral scanner (MSS) is evaluated as a means of estimating lacustrine trophic state. Numerical classificatory methods are employed to ascertain the trophic character of 100 lakes in Minnesota, Wisconsin, Michigan, and New York. Principal components analysis is used to derive a multivariate trophic state index (PCI) using the trophic indicators chlorophyll A, conductivity, inverse of Secchi depth, total phosphorus, an algal assay yield, and total organic nitrogen. A binary masking technique is used to extract lake related MSS data from digital tapes (CCTs). MSS color ratio models are developed which give good estimates of Secchi depth and fair estimates of chlorophyll A levels. Trophic state, as defined by lake position on the first principal component axis (PCI), is predicted using MSS color ratio regression models. GRA

N77-14570*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT. NON-US STANDARD CATALOG NO. N-34

30 Jun. 1975 165 p

(NASA-TM-X-74270) Avail: NTIS HC A08/MF A01 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Section 1 and 2 described the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Sections 4 and 5 cover LANDSAT-1 and LANDSAT-2 coverage, respectively. Author

N77-14571# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Mobility and Environmental Systems Lab.

DEMONSTRATION OF A NEW TECHNIQUE FOR RAPIDLY SURVEYING ROOF MOISTURE Final Report, Apr. 1975 - Mar. 1976

Lewis E. Link, Jr. Jun. 1976 52 p ref

(AD-A026722; WES-MP-M-76-14) Avail: NTIS HC A04/MF A01 CSCL 13/13

The results of this study demonstrate the potential of the combined thermal IR-nuclear moisture meter roof survey technique described herein. Application of the technique at Dyess AFB, Texas, resulted in the detection of roof areas with entrapped moisture on 5 of the 128 buildings surveyed. Airborne thermal IR imagery proved to be a very effective means of identifying roof areas with potential entrapped moisture. Some false alarms were created by air vents on smaller buildings; however, prior knowledge of the position of the vents (i.e. during the examination of the imagery) would probably reduce this problem considerably. Not all the questions were answered. Information is needed to

define the usefulness of the technique as a function of climatic conditions and roof types. In addition, more data are needed to help define the optimum time for acquiring thermal IR imagery for roof moisture surveys. Author (GRA)

N77-14572# California Univ., Davis. Water Resources Center.

PROCEEDINGS 10TH BIENNIAL CONFERENCE ON GROUND WATER, TOTAL WATER MANAGEMENT FOR CALIFORNIA'S LONG-RANGE NEEDS

Dec. 1975 274 p refs Conf. held at Ventura, Calif., 11-12 Sep. 1975 Sponsored by Calif. State Dept. of Water Resources, Sacramento

(PB-256808/7; W76-11491) Avail: NTIS HC A12/MF A01 CSCL 13B

The conference, co-sponsored by the California Dept. of Water Resources and the California Water Resources Center, included papers under the following session topics: Innovation in Conjunctive Use of Ground and Surface Water; Ground Water Conservation, Protection and Use--Some Technical and Institutional Considerations; Energy and Economic Considerations in the Use and Development of Ground Water; and Legal and Regulatory Aspects. GRA

N77-14573# NUS Corp., Rockville, Md.

AVAILABILITY OF POTENTIAL COAL SUPPLY THROUGH 1985 BY QUALITY CHARACTERISTICS

Landy A. Stinnett, George W. Toth, Shirley C. Barber, Jeffrey B. Goodman, and Jasper Maltese Aug. 1976 121 p refs

(Contract FEA-CO-05-60574-00)

(PB-256680/0; NUS-1725; FEA/G-76/367) Avail: NTIS HC A06/MF A01 CSCL 21D

The availability of uncommitted low-sulfur coal was analyzed in terms of quantity, quality, and timeliness of production and uncommitted recoverable coal which is potentially available for production. The effects on coal availability of manpower, equipment, availability, economics, ownership, and regulations were considered implicitly by virtue of the responses received in the market survey. GRA

N77-14574# Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.

INTERDISCIPLINARY / INTERINSTITUTIONAL REQUIREMENTS FOR WATER RESOURCE PLANNING: PROCESSES TO ENHANCE COOPERATION

George W. Reid and James O. Dritt Jan. 1976 132 p refs Sponsored by the Dept. of Interior

(PB-255632/2; W76-10609; OWRT-X-122(3749)(1)) Avail: NTIS HC A07/MF A01 CSCL 13B

Difficulties and opportunities for effective cooperation within an interdisciplinary research group are explored. While emphasizing such research within an academic environment and on water resources related cases, this study is directed toward a broad spectrum of research project leaders and team participants. The analytical framework was designed to point out differences that exist between single, multidisciplinary and interdisciplinary team research. An opportunity to respond and share future results is provided. Several steps were suggested for the optimal use of interdisciplinary personnel in water resources research. The salient organizational and situational conditions include the establishment of favorable internal relationships and coalitions as a basis for administrative support and cooperation. GRA

N77-14575# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

USE OF AUTOMATED REMOTE SENSING TECHNIQUES TO DEFINE THE MOVEMENT OF TOW-GENERATED SUSPENDED MATERIAL ON THE ILLINOIS AND UPPER MISSISSIPPI RIVERS Final Report

Lewis E. Link, Jr. and Albert N. Williamson, Jr. Jun. 1976 73 p refs

(AD-A025733; WES-TR-M-76-6) Avail: NTIS HC A04/MF A01 CSCL 14/5

Sequential color-infrared aerial photos and corresponding surface water samples were obtained at selected sites on the Illinois and Upper Mississippi Rivers to examine the movement of tow-generated suspended material plumes. The aerial photos were digitized with a scanning microdensitometer, and optical density values were extracted for correlation with suspended material concentration data obtained by laboratory analysis of the water samples. Correlation of the optical density and concentration values for each site and for sample positions at each site did not produce a statistically significant relation between the variables. The poor correlation between optical density and concentration values prevented quantitative definition from the imagery of the distribution of suspended material concentrations at the sites as a function of time. Digital data handling procedures were used to enhance the visibility on the imagery of the tow-generated plumes. The procedures applied were successful in delineating the movement and dissipation of the tow-generated plumes under favorable sun and water conditions. GRA

N77-14576# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

MICROCOPYING WILDLAND MAPS FOR DISTRIBUTION AND SCANNER DIGITIZING Final Report

Elliot L. Amidon and E. Joyce Dye 1976 18 p refs Sponsored by the Dept. of Agriculture

(PB-257030/7; FSRP-PSW-114) Avail: NTIS HC A02/MF A01 CSCL 08B

Images in graphic or printed form can be reduced in size by microcopying. Microform is a collective term for stored microimages. Conventional microform films include silver halide, nonsilver diazo, vesicular, and color. Criteria for selecting the proper format include map quadrangle size and reduction ratio. Among several competing types of microforms, only microfilm and microfiche were judged acceptable for application to wildland maps. Microimages can be digitized by automatic techniques. With careful planning, it is possible to digitize automatically forest map microimages for input to computerized mapping systems. Other benefits of microcopying include a reduction in the cost of handling and shipping the original documents, savings in space, and making archival copies more lasting. GRA

N77-14577# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

EVALUATION OF ERTS-1 DATA FOR FOREST AND RANGELAND SURVEYS Final Report

Robert C. Heller 1975 78 p refs Sponsored by the Dept. of Agriculture

(PB-257029/9; FSRP-PSW-112) Avail: NTIS HC A05/MF A01 CSCL 02F

Tests were done using data gathered by the first Earth Resource Technology Satellite. Results on sites in Georgia, Colorado, and South Dakota indicated that ERTS enlargements, preferably color, would be useful to forest managers of large ownerships for broad area planning. Forest land was distinguished from non-forest land with 90 to 95 percent accuracy, in both photointerpretation and computer-assisted analysis. Further breakdowns of cover types could not be made with acceptable accuracy by either method. Forest disturbances from natural causes or human activity could be detected with 90 percent accuracy when ERTS imagery was compared with 6-year-old aerial photos. Stress from mountain pine beetle could not be detected; ERTS wavebands are too broad to identify dying foliage. Color illustrations reproduced in black and white. GRA

N77-14578# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Mobility and Environmental Systems Lab.

THE USE OF REMOTE SENSING SYSTEMS FOR ACQUIRING DATA FOR ENVIRONMENTAL MANAGEMENT PURPOSES. REPORT 3: A NOMOGRAM FOR COMPUTING OPTICAL DENSITY CONTRAST Technical Report, 1 Jan. 1974 - 1 Jan. 1975

Lewis E. Link, Jr. and James R. Stabler May 1976 83 p refs

(DA Proj. 4A7-62720-A-986)

(AD-A026718; WES-TR-M-74-8-3) Avail: NTIS HC A05/MF A01 CSCL 17/8

Previous efforts as part of this program resulted in a new capability for predicting photographic-image optical density contrasts. The product of the efforts was a computerized system model that provides a rigorous, quantitative means of objectively selecting a sensor system and mission profile to enhance the success of a remote sensing data acquisition program. The

execution of the model requires computer facilities and specialized personnel. A graphical form of the model was developed to provide a simple planning tool that can be applied by users having a wide range of backgrounds and without computer facilities. This report presents a nomogram for predicting optical density contrasts on aerial photographs. The concept and formulation of the nomogram are discussed and an example of its application presented. The accuracy of the nomogram with respect to the computer program from which it was derived is also evaluated. Author (GRA)

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N77-14579 Committee on Science and Technology (U. S. House).
INVENTORY OF ENERGY RESEARCH AND DEVELOPMENT (1973 - 1975), VOLUME 5
Washington GPO 1976 160 p refs Rept. for Subcomm. on Energy Res., Development and Demonstration of Comm. on Sci. and Technol., 94th Congr. 2d Sess., Jan. 1976 Sponsored by ERDA and NSF Prepared by ORNL
(GPO-64-734) Avail: SOD HC $2.30

The survey measures the research and development (R and D) efforts to expand the sources of energy as well as R and D aimed at controlling the impact of energy production and use on the environment. These inventory studies afford an overview of the R and D being performed in every aspect of energy exploration, production, distribution, use, and conservation.
Author

N77-14580* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SILICON NITRIDE COATED, PLASTIC COVERED SOLAR CELL Patent
Jacob D. Broder, inventor (to NASA) Issued 7 Dec. 1976 4 p Filed 30 Dec. 1975 Supersedes N76-14613 (14 - 05, p 0604)
(NASA-Case-LEW-11496-1; US-Patent-3,996,067; US-Patent-Appl-SN-645508; US-Patent-Class-136-89; US-Patent-Class-204-192) Avail: US Patent Office CSCL 10A

A non-oxide anti-reflective coating was used with a transparent plastic cover of fluorinated ethylene propylene copolymer on a silicon solar cell to increase the resistance to damage caused by electron bombardment.
Official Gazette of the U.S. Patent Office

N77-14581* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRICALLY RECHARGEABLE REDOX FLOW CELL Patent
Lawrence H. Thaller, inventor (to NASA) Issued 7 Dec. 1976 6 p Filed 22 Aug. 1975 Supersedes N75-32586 (13 - 23, p 2938)
(NASA-Case-LEW-12220-1; US-Patent-3,996,064; US-Patent-Appl-SN-606891; US-Patent-Class-320-2; US-Patent-Class-429-23; US-Patent-Class-429-34) Avail: US Patent Office CSCL 10C

A bulk energy storage system is designed with an electrically rechargeable reduction-oxidation (REDOX) cell divided into two compartments by a membrane, each compartment containing an electrode. An anode fluid is directed through the first compartment at the same time that a cathode fluid is directed through the second compartment. Means are provided for circulating the anode and cathode fluids, and the electrodes are connected to an intermittent or non-continuous electrical source, which when operating, supplies current to a load as well as to the cell to recharge it. Ancillary circuitry is provided for disconnecting the intermittent source from the cell at prescribed times and for circulating the anode and cathode fluids according to desired parameters and conditions.
Official Gazette of the U.S. Patent Office

N77-14582 Carnegie-Mellon Univ., Pittsburgh, Pa.
DESIGN AND MODELING OF SOLAR SEA POWER PLANTS BY GEOMETRIC PROGRAMMING Ph.D. Thesis
Chin Chang Wu 1976 159 p
Avail: Univ. Microfilms Order No. 76-19981

Geometric programming, a nonlinear optimization technique, is used to design Solar Sea Power Plants (SSPP) which convert the thermal energy stored in the tropical water into electricity. First, the conversion process is described, and the hardware necessary to implement a binary-fluid, closed-Rankine cycle is identified. Next, steady-state analytical models for the major components are derived. These models are then used as the constraints of a geometric program whose objective function is the minimization of a particular function of the design variables of the SSPP. A variety of problems are solved. The geometric programming technique produces the optimum design and, more importantly, the sensitivity of the objective function at the optimum to variations in cost figures, constraint bounds, and arbitrary constants of the model. Dissert. Abstr.

N77-14583 Utah State Univ., Logan.
A FERMENTATION PROCESS FOR CONVERTING PLANT MATERIALS INTO METHANE Ph.D. Thesis
Somayajula Chalapati Sarma 1976 182 p
Avail: Univ. Microfilms Order No. 76-25631

A fermentation procedure for converting agricultural crops into methane was developed by dividing the conventional anaerobic process into two distinct stages. A digestor capable of fermenting plant materials into volatile fatty acids was developed. The problem of formation of scum layer often accompanied in fermentation of plant materials was totally eliminated, as well as mixing of the methane digestor. Volatile acids formed by the plant materials were found to be nutritionally adequate for methane bacteria. Methane production increased with increasing concentration of volatile fatty acids up to a limit of 8000 milligrams per liter. When the concentration of acids exceeded this limit, the pH rapidly declined as did the methane production. A perpetual energy converting system incorporating the fermentation processes developed is suggested as a substitute for fossil fuels in food production. Dissert. Abstr.

N77-14584*# North Carolina Science and Technology Research Center, Research Triangle Park.
SOLAR ASSISTED HEAT PUMPS: A POSSIBLE WAVE OF THE FUTURE
Frederick O. Smetana Washington Dec. 1976 24 p
(Contract NAS1-14208)
(NASA-CR-2771) Avail: NTIS HC A02/MF A01 CSCL 10A

With the higher costs of electric power and the widespread interest to use solar energy to reduce the national dependence on fossil fuels, heat pumps are examined to determine their suitability for use with solar energy systems. Author

N77-14585*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEW SEPARATORS FOR NICKEL-ZINC BATTERIES
Dean W. Sheibley Washington Dec. 1976 20 p refs
(NASA-TM-X-3465; E-8915) Avail: NTIS HC A02/MF A01 CSCL 10C

Flexible separators consisting of a substrate coated with a mixture of a polymer and organic and inorganic additives were cycle tested in nickel-zinc cells. By substituting a rubber-based resin for polyphenylene oxide in the standard inorganic-organic separator, major improvements in both cell life and flexibility were made. Substituting newsprint for asbestos as the substrate shows promise for use on the zinc electrode and reduces separator cost. The importance of ample electrolyte in the cells was noted. Cycle lives and the characteristics of these flexible, low-cost separators were compared with those of a standard microporous polypropylene separator. Author

N77-14586*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF INFORMATION SYSTEMS FOR HYDROPOWER OPERATIONS: EXECUTIVE SUMMARY
Robert L. Sohn, Leonard Becker, John Estes, David Simonett, and William Yeh Sep. 1976 48 p
(Contract NAS7-100)
(NASA-CR-149342; JPL-5040-43; RTOP-777-30-01) Avail: NTIS HC A03/MF A01 CSCL 10B

An analysis was performed of the operations of hydropower systems, with emphasis on water resource management, to determine how aerospace derived information system technologies can effectively increase energy output. Better utilization of water resources was sought through improved reservoir inflow forecasting based on use of hydrometeorologic information systems with new or improved sensors, satellite data relay systems, and use of advanced scheduling techniques for water release. Specific mechanisms for increased energy output were determined, principally the use of more timely and accurate short term (0-7 days) inflow information to reduce spillage caused by unanticipated dynamic high inflow events. The hydrometeorologic models used in predicting inflows were examined in detail to determine the sensitivity of inflow prediction accuracy to the many variables employed in the models, and the results were used to establish information system requirements. Sensor and data handling system capabilities were reviewed and compared to the requirements, and an improved information system concept was outlined. Author

N77-14587# Sandia Labs., Albuquerque, N.Mex.
SYNERGISTIC EFFECTS OF SHADOWING ON A SOLAR COLLECTOR MATRIX
David O. Lee and Walter P. Schimmel, Jr. Apr. 1976 89 p refs
(Contract AT(29-1)-789)
(SAND-76-0012) Avail: NTIS HC A05/MF A01

An analytical expression for the shadowing of a collector by adjacent units is presented as a function of collector location, spacing, and orientation. Hourly variations of solar input, as well as the seasonal effects of the solar zenith angle, were considered. An axial temperature analysis was employed, through use of the shadowing expression, to determine the output of a linear focused solar collector when shadowed by adjacent collectors. Outputs for several spacing configurations were presented for a north/south oriented collector field. Calculations were based on fixed-tilt east/west tracking systems. The effect of the time of day on the collector output was included for the equinoxes and solstices for Albuquerque, N. M. ERA

N77-14588# Battelle Columbus Labs., Ohio.
SOLAR-POWERED HEAT PUMP UTILIZING PIVOTING-TIP ROTATING EQUIPMENT, PHASE 1 Summary Report, 1 Jul. 1974 - 1 Sep. 1975
Robert D. Fischer, Donald H. Frieling, Sherwood G. Talbert, and James A. Eibling 29 Sep. 1975 113 p refs Sponsored by ERDA
(Contract NSF C-876)
(NSF/RANN/SE/C-876/FR/75/3) Avail: NTIS HC A06/MF A01

A feasibility study of an advanced concept of a Rankine heat-pump system for solar heating and cooling of buildings was conducted. Distinctive features of the Battelle Rankine heat pump included a rotary-vane compressor and expander with pivoting-tip vanes for reduced friction, a single refrigerant, and a common condenser. Favorable results from system-design studies and experimental studies of pivoting-tip performance in this study demonstrated that the concept merits further investigation. ERA

N77-14589# Arizona State Univ., Tempe.
TERRESTRIAL PHOTOVOLTAIC POWER SYSTEMS WITH SUNLIGHT CONCENTRATION Annual Progress Report, 1 Jan. - 31 Dec. 1975
C. E. Backus 31 Jan. 1976 257 p refs Prepared in cooperation with Spectrolab, Inc., Sylmar, Calif.
(Contract E(11-1)-2590)
(COO-2590-2) Avail: NTIS HC A12/MF A01

The characteristics of the components and the total system using sunlight concentrated onto solar cells was investigated. Cells were fabricated that were designed for different intensities. Typically the efficiency of a cell will increase from its 11 percent at AM1 peak to efficiency at the designed concentration level and return to its initial efficiency at about 3 times its designed concentration level. The developed cells were tested under high intensity simulators and in concentrated sunlight and have shown the predicted response. The experimental testing of passive cooling limitations for cooling cells with just finned arrangements in the back of the cell was completed in the controlled environment of a wind tunnel. These experiments have confirmed the heat transfer coefficients that were used in the analytical studies. Testing was done to collect heat transfer coefficients for actual wind conditions and these data show good agreement with the controlled wind tunnel data. ERA

N77-14590# California Univ., Livermore. Lawrence Livermore Lab.
SHALLOW JUNCTION SOLAR CELLS FABRICATED BY CORONA DISCHARGE
R. Wichner and E. J. Charlson (Missouri Univ., Columbia) 10 Mar. 1976 17 p refs Presented to the 17th Electronic Materials Conf., Princeton, New Jersey, 25-27 Aug. 1975 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-76790; Conf-750882-1) Avail: NTIS HC A02/MF A01

A technique for producing p-n junction silicon solar cells was developed involving the use of a continuous gaseous discharge operating in the corona mode. The process is applicable to the production of p on n or n on p structures. Detailed results are presented for a BF3 discharge, producing p on n cells, along with preliminary results using a PF5 discharge, resulting in n on p cells. Efficiencies of over 8 percent were obtained on single crystal Si p on n cells, at AM1 without an antireflective coating, and of over 3 percent for a heavily defected polycrystalline cell under the same conditions. Fill factors as high as 0.76 were obtained. Analysis of these cells include ion microprobe mass analysis and anodic stripping for concentration profiles, and capacitance voltage and current--voltage measurements for electrical characterization. ERA

N77-14591# Sandia Labs., Albuquerque, N.Mex. Exploratory Batteries Div. 2523.
SIXTY-MINUTE THERMAL BATTERY
D. M. Bush Mar. 1976 20 p refs
(Contract AT(29-1)-789)
(SAND-75-0454) Avail: NTIS HC A02/MF A01

Investigations to develop a reliable 60 minute thermal battery continued. Results obtained with the latest group of XP60 batteries consisting of 111 units are summarized. Five identical batteries, incorporating design changes resulting from these investigations had an average life of 69 minutes; all exceeded 60 minutes. Battery tests designed to identify the reactants which cause internal heat generation were also conducted. ERA

N77-14592# Argonne National Lab., Ill.
EXPLAINING ENERGY: A MANUAL OF NON-STYLE FOR THE ENERGY OUTSIDER WHO WANTS IN
Lee Schipper (Calif. Univ., Berkeley) Jan. 1976 75 p refs Sponsored by ERDA
(LBL-4458; ERG-76-04) Avail: NTIS HC A04/MF A01

A guide or outline of the most asked about, controversial, and basic characteristics of energy systems was assembled. The parameters of supply, demand, environmental impact, growth, conservation, future energy sources, research and development, and certain socio-political issues form the basis of all discussions of energy. Nuclear fission and fusion, fossil fuels, solar energy, and geothermal energy are the most promising sources that are receiving attention at present. Information is included on obtaining material at little or no cost from Congressional committees, government bureaus, the Government Printing Office, industry and lobby groups, environmental organizations, and research institutions. References in the bibliography citing 834 items emphasize the use of energy choices, through many of the general references form the framework of standard energy forecasts and methodology. Author (ERA)

N77-14593# General Electric Co., Schenectady, N.Y.
ECONOMIC AND TECHNICAL FEASIBILITY STUDY OF COMPRESSED AIR STORAGE Final Report
Mar. 1976 402 p refs
(Contract E(11-1)-2559)
(COO-2559-1) Avail: NTIS HC A18/MF A01

The economic and technical feasibility of compressed air energy storage (CAES) is presented. The application of underground air storage with combustion turbines was the primary issue. A general assessment of the technical alternatives, economic characteristics and the institutional constraints associated with underground storage of compressed air for utility peaking application was carried out. Potential barrier problems were identified, and the incentive for the implementation of compressed air storage was defined. The conceptual design of a CAES plant employing storage in an aquifer and that of a plant employing storage in a conventionally excavated cavern employing a water leg to maintain constant pressure are shown. Recommendations for further work, as well as directions of future turbomachinery development, are made. Compressed air storage is technically feasible for off-peak energy storage, and, depending on site conditions, CAES plants may be favored over simple cycle turbine plants to meet peak demands. Author (ERA)

N77-14594# Institute for Energy Analysis, Oak Ridge, Tenn.
IEA ENERGY SIMULATION MODEL: A FRAMEWORK FOR LONG-RANGE US ENERGY ANALYSIS
Charles E. Whittle, David B. Reister, Ernest G. Silver, J. Frederick Weinhold, S. Basheer Ahmed, Harry E. Davitian, H. G. MacPherson, and Alfred M. Perry Jan. 1976 160 p refs
(Contract ERDA-14-01-0001-1699)
(ORAU-125; IEA-75-1) Avail: NTIS HC A08/MF A01

A model was developed for simulating plausible U. S. energy supplies and demands for the last part of this century and the early part of the 21st century. This model was intended to give policy makers a means of comparing various possible futures for energy supplies and demands and for determining which combinations allow a feasible match between the projected demands and the available domestic supplies. Demand functions were generated for each of the energy carriers (electricity, liquids, gases, and solids) by examining the industrial, residential and commercial, and transportation demand sectors in terms of their component activities. Supply functions have been generated independently for each of the energy carriers based on the best available data and estimates for the fossil fuels, uranium, hydroelectricity, geothermal heat, and solar energy and on present knowledge and projections about extraction and conversion technology. ERA

N77-14595# Northwestern Univ., Evanston, Ill.
INTERFACIAL EFFECTS IN THE RECOVERY OF RESIDUAL OIL BY DISPLACEMENT: STUDIES AT NORTHWESTERN UNIVERSITY Annual Report, 1 Mar. 1975 - 29 Feb. 1976
J. C. Slattery and A. A. Kovitz Feb. 1976 47 p refs
(Contract E(34-1)-0019)
(COO-0019-5) Avail: NTIS HC A03/MF A01

A static analysis of a single irregular pore partially filled with residual oil was performed. There is a critical value for the pressure drop over this pore below which the residual oil cannot be displaced but instead will assume a static configuration. The pore was idealized by saying that its radius is a sinusoidal function of axial position. It was recognized that the pressure drop across the pore under static conditions is a function of the pore geometry, the volume of the oil segment, the position of the oil segment in the pore, the crude oil--water interfacial tension, the advancing contact angle, and the receding contact angle. ERA

N77-14596# California Univ., Livermore. Lawrence Livermore Lab.
REACTIVITY OF OIL SHALE CARBONACEOUS RESIDUE WITH OXYGEN AND CARBON DIOXIDE
R. G. Mallon and R. L. Braun 23 Apr. 1976 36 p refs Presented at the 9th Oil Shale Symp., Golden, Colo., 29 - 30 Apr. 1976
(Contract W-7405-eng-48)
(UCRL-77829; Conf-760443-1) Avail: NTIS HC A03/MF A01

The reactivity of char was investigated by experiments on individual blocks of oil shade with a controlled temperature and gas environment. The results illustrated that the char-O2 reaction rate was by the rate of O2 diffusion. The effective diffusivity of O2 increased with the square of the kerogen concentration of the raw shale, as predicted by theoretical considerations. However, the measured diffusivities were appreciably greater than theoretical. The difference was attributed to the network of small cracks that developed during the early part of the retorting process. The results also clearly demonstrated another important mechanism for consumption of char within the oil shale block: the reaction of char with the CO2 produced from the decomposition of dolomite and calcite. ERA

N77-14597# United Technologies Corp., South Windsor, Conn. Power Systems Div.
NATIONAL BENEFITS ASSOCIATED WITH COMMERCIAL APPLICATION OF FUEL CELL POWERPLANTS
27 Feb. 1976 67 p Sponsored by ERDA
(ERDA-76-54) Avail: NTIS HC A04/MF A01

Major privately sponsored research and technology efforts, now in progress, are aimed at developing the fuel cell for utility industry applications. These efforts, supported by both electric industry and gas industry elements, are developing the fuel cells for two major areas of application. In the first application, multimegawatt fuel cell powerplants would be dispersed within electric utility networks to complement large-scale systems and provide for the generation needs of small private and public utilities. In the second mode, smaller size fuel cells would be sited at building locations to provide integrated electric and thermal service for commercial and industrial complexes. With continued funding of planned programs, utility application of the fuel cell could result within this decade. The application opportunities for first generation fuel cell powerplants were outlined, improvements that these systems can offer in comparison with conventional electric generation techniques were quantified, and, in the context of a range of potential deployment scenarios, the benefits to the nation as a result of these improvements were quantified. ERA

N77-14598# Sandia Labs., Albuquerque, N.Mex.
STABILITY OF SLAG IN TURBULENT MHD BOUNDARY LAYERS
W. S. Saric (Virginia Polytech. Inst. and State Coll., Blacksburg.) and K. J. Touryan 1976 16 p refs Sponsored by ERDA
(SAND-76-5021) Avail: NTIS HC A02/MF A01

Slag formation on MHD channel walls from the direct combustion of coal has proven to be an asset to channel performance and duration. Over hot electrode walls, the slag forms a thin, viscous liquid layer, driven by pressure and shear forces generated in the gas boundary layer. At a given location in the channel, the slag thickness obviously depends upon the balance between rate of slag deposition and rate of slag removal. Deposition normally occurs from the vapor phase and liquid drops of slag mixed in the gas stream, produced in the combustion chamber. Slag removal occurs through liquid layer flow and in addition, through vaporization and entrainment. Wettability, or surface bonding, is also critical for slag layer formation on the electrode and insulator surfaces. The ability to predict, quantitatively, the rate of slag removal caused by one or more of these mechanisms will enable the designer to estimate slag replenishment rates necessary to maintain the required protective layer over the electrodes. ERA

N77-14599# Sandia Labs., Albuquerque, N.Mex.
SANDIA VERTICAL AXIS WIND TURBINE PROGRAM Technical Quarterly Report, Oct. - Dec. 1975
James F. Banas, ed. and William N. Sullivan, ed. Apr. 1976 113 p refs
(Contract AT(29-1)-789)
(SAND-76-0036) Avail: NTIS HC A06/MF A01

Information is presented concerning: review of the status of general design efforts in the areas of aerodynamics, structures, systems analysis, and testing; summary of preliminary design details of the proposed 17-m turbine/60-kW generator system for power grid application; and structural analysis and operational test results for the existing 5-m turbine. ERA

N77-14600# Oklahoma Univ., Norman. School of Chemical Engineering and Materials Science.
RESOURCE UTILIZATION EFFICIENCY IMPROVEMENT OF GEOTHERMAL BINARY CYCLES, PHASE 1 Semiannual Progress Report, 15 Jun. - 15 Dec. 1975
K. E. Starling, L. W. Fish, K. Z. Iqbal, and D. Yieh 1975 299 p refs
(Contract E(40-1)-4944)
(ORO-4944-3) Avail: NTIS HC A13/MF A01

A description of the geothermal binary cycle and procedures for cycle thermodynamic analysis focusing on the question of resource utilization are discussed. General and specific criteria for preliminary selection of working fluids and operating conditions for binary cycles are considered in terms of equipment and working fluid costs and resource utilization efficiency. Steps are given for preliminary binary cycle design computations. Preliminary evaluations of alternative pure working fluid, ideal thermodynamic cycles are illustrated. The development of the working fluid mixture thermodynamic cycle, GEO I, using the improved versions of previously developed thermodynamic properties routines was the first of several significant accomplishments. ERA

N77-14601# Los Alamos Scientific Lab., N.Mex.
GEOTHERMAL ENERGY FOR ELECTRICAL AND NONELECTRICAL APPLICATIONS
J. W. Tester and S. L. Milora 1976 10 p refs Presented at 16th Ann. ASME Symp. on Energy Alternatives, Albuquerque, N. Mex., 26 Feb. 1976
(Contract W-7405-eng-36)
(LA-UR-76-418; Conf-760215-3) Avail: NTIS HC A02/MF A01

The utilization of geothermal fluids ranging in temperature from 100 to 300 C is discussed from a thermodynamic and an economic viewpoint. Nonaqueous working fluids are evaluated for possible use in sub- and supercritical Rankine power generating cycles, and are compared to more conventional steam flashing cycles. Criteria are presented for determining performance based on the cycle's effectiveness in utilizing the geothermal fluid. Working fluid thermodynamic properties are used to correlate optimum cycle performance at given geothermal fluid temperatures. A generalized method for expressing turbine exhaust end sizes is developed. The geothermal resource potential of the United States for both natural hydrothermal systems and artificially stimulated, dry hot rock systems is discussed. The economics of generating power and of direct utilization for space and process heating applications are compared with fossil fuel and nuclear energy sources. Author (ERA)

N77-14602# Battelle Pacific Northwest Labs., Richland, Wash.
ECONOMICS OF GEOTHERMAL ELECTRICITY GENERATION FROM HYDROTHERMAL RESOURCES
C. H. Bloomster and C. A. Knutsen 23 Apr. 1976 46 p refs
(Contract E(45-1)-1830)
(BNWL-1989) Avail: NTIS HC A03/MF A01

The most important factors affecting the economics of geothermal electricity production are the wellhead temperature or enthalpy, the well flow rate, and the cost of the wells. The capital cost of the powerplant is significant, but not highly sensitive to these resource characteristics. The optimum geothermal plant size will remain small, usually in the 50-100 MWe range. Therefore, the opportunities for achieving significant cost reductions through economies of scale are small. The steam and binary power cycles are closely competitive; the binary cycle appears better when the brine temperature is below 200-230 C, and the flashed steam cycle appears better above this range. Geothermal electricity production is capital intensive; over 75 percent of the generation costs are fixed costs related to capital investment. Technological advances are needed to reduce costs from marginal geothermal resources and thus to stimulate geothermal energy development. Significant reduction in power costs would be achieved by reducing well drilling costs, stimulating well flow rates, reducing power-plant capital costs, increasing powerplant efficiency and utilization, and developing more effective exploration techniques for locating and assessing high-quality resources. Author (ERA)

N77-14603# Bechtel Corp., San Francisco, Calif.
ELECTRIC POWER GENERATION USING GEOTHERMAL BRINE RESOURCES FOR A PROOF-OF-CONCEPT FACILITY
1976 262 p refs
(Grant NSF AER-74-19931)
(NSF/RA/N-75-049) Avail: NTIS HC A12/MF A01

The initial phase of a proof of concept project to establish the technical, environmental, and economic feasibility of utilizing hot brine resources for electric energy production and other industrial applications is reported. Included are the following: summary, conclusions, and recommendations; site selection; Heber site description; development of design bases for an experimental facility and a 10 MWe(Net) generating unit; description of facilities; safety analysis environmental considerations; implementation plan and schedule; and conceptual capital cost estimate. ERA

N77-14604# California Univ., Livermore. Lawrence Livermore Lab.
LLL-SOHIO SOLAR PROCESS HEAT PROJECT. REPORT NO. 3: LLL SOLAR ENERGY GROUP
W. C. Dickinson, A. F. Clark, A. Iantuono, R. E. Parsons, D. V. Chakedis, W. G. Gensler, and W. L. Ahlgren 1 Apr. 1976 29 p refs
(Contract W-7405-eng-48)
(UCID-16630-3) Avail: NTIS HC A03/MF A01

A shallow solar pond prototype facility was built and operated in New Mexico. The facility consists of three 11.5 ft x 200 ft shallow solar ponds, cold and hot water storage reservoirs, and instrumentation to measure the performance of the ponds as solar thermal collectors. The basic theory of shallow ponds is described and compared with the performance of the New Mexico ponds to similar ponds. Agreement of calculated and experimental values of daily collected heat is better than 10 percent. The annual average collection efficiency for the ponds is close to 50 percent, corresponding to an annual collection of between, 0.25 and 0.30 MBtu/sq ft collector. We found that the annual collected heat would be reduced by only about 10 percent if the ponds were operated 9 months of the year. ERA

N77-14605# Aerojet Nuclear Co., Idaho Falls, Idaho.
GEOTHERMAL R AND D PROJECT REPORT Technical Report, 1 Oct. - 30 Dec. 1975
Apr. 1976 48 p refs
(Contract E(10-1)-1375)
(ANCR-1283) Avail: NTIS HC A03/MF A01

The Idaho National Engineering Laboratory geothermal research and development project is conducting two major geothermal development efforts: (1) a project aimed at medium temperature (approximately 300 F) utilization to produce electricity with supplemental direct thermal use of the energy; and (2) a low temperature (approximately 170 F) space heating project. The first effort was progressed in the field to the successful drilling of two deep geothermal wells providing flows of the desired temperature in the Raft River Valley of south central Idaho. The second program involves the heating of government buildings and a university campus at Boise, Idaho. ERA

N77-14606# Army Construction Engineering Research Lab., Champaign, Ill.
INTERIM FEASIBILITY ASSESSMENT METHOD FOR SOLAR HEATING AND COOLING OF ARMY BUILDINGS Final Report
Doug Hittle, D. Holshouser, and G. Walton May 1976 54 p refs
(DA Proj. 4A7-63734-DT-08)
(AD-A026588; CERL-TR-E-91) Avail: NTIS HC A04/MF A01 CSCL 13/1

This report discusses design considerations for heating and cooling buildings with solar energy. General criteria are provided for selecting the components and configuration of such a system. The report presents parametric computer simulation studies for two buildings of typical construction at five locations in the United States. Hourly building heating and cooling loads were computed for each building at each site using the National Bureau of Standards Load Determining Program (NBSLD) and hourly weather data. Using these loads, hourly simulation studies were performed to determine the effects of collector type, collector area, collector tilt angle, thermal energy storage tank volume,

and heat exchanger effectiveness on simulated solar heating and cooling system performance. The results of more than 200 one-year solar system simulations are presented. In addition, a dimensionless graph and methodology are provided which can be used to estimate solar heating and cooling system performance for buildings and sites other than those studied. The report provides an explanation and an example of an approach for determining the life cycle cost of a solar-equipped building as compared to a conventional installation. Descriptions of the NBSLD program and the solar heating and cooling simulation program are provided. Author (GRA)

N77-14607# Naval Postgraduate School, Monterey, Calif.
SOLID STATE APPLICATIONS OF DIRECT ENERGY CONVERSION AND HEAT PUMPING FOR A SMALL AUTOMOTIVE VEHICLE Ph.D. Thesis
Thomas Constantine Tsoukalas Sep. 1975 142 p refs
(AD-A026321) Avail: NTIS HC A07/MF A01 CSCL 13/1

The feasibility of solid state application for electrical power generation and heat pumping in small automotive vehicles has been examined. A new geometric configuration for the thermoelectric couple was introduced and the heat flow problem has been solved analytically in detail. The obtained results appeared promising for future developments in this area. Author (GRA)

N77-14608# Federal Energy Administration, Washington, D.C. Office of Policy and Analysis.
WEEKLY PETROLEUM STATISTICS REPORTS, 1974-1975
Aug. 1976 493 p
(PB-255920/1; FEA/B-76/335) Avail: NTIS HC A21/MF A01 CSCL 21D

A complete collection of 46 issues of the Weekly Petroleum Statistics Report, beginning April 4, 1974 and ending May 24, 1974. The weekly reports contain reporting by all petroleum refiners, bulk terminal operators and importers of their domestic petroleum receipts, imports, operating rates, production of each major petroleum product and stock levels. GRA

N77-14609# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
ENERGY EQUIVALENTS FOR CURRENT AND PROSPECTIVE AUTOMOTIVE FUELS IN CANADA
D. B. Coveney, M. J. Friend, and G. M. Shulhan Feb. 1976 52 p refs Submitted for publication
(AD-A026195; DME-MD-53; NRC-15233; ISSN-0077-555X) Avail: NTIS HC A04/MF A01 CSCL 21/4

The report provides a first estimate of the comparative energy equivalents and the energy efficiencies of existing and prospective Canadian automotive fuels. GRA

N77-14610# Federal Energy Administration, Washington, D.C. Strategic Petroleum Reserve Office.
THE EXPLORATION, DEVELOPMENT, AND PRODUCTION OF NAVAL PETROLEUM RESERVE NUMBER 4
Aug. 1976 85 p ref
(PB-255947/4; FEA/S-76/330) Avail: NTIS HC A05/MF A01 CSCL 21D

The Naval Petroleum Reserves Production Act (NPRPA) mandates Government exploration of the Naval Petroleum Reserve Number 4 (NPR-4), but authorizes no development or production of petroleum discoveries. Obtaining the necessary legislative authority to lease, performing environmental impact studies, and setting a leasing procedure in motion will consume approximately 2 to 3 years. Recommendations for the development of NPR-4 petroleum reserves are presented. GRA

N77-14611# California Univ., Livermore. Lawrence Livermore Lab.
INDUSTRIAL PROCESS HEAT FROM SHALLOW SOLAR PONDS
A. F. Clark 1976 8 p refs Presented to the 2d Southeastern Conf. on Application of Solar Energy, Baton Rouge, La., 19-23 Apr. 1976
(Contract W-7405-eng-48)
(UCRL-77801; Conf-760423-1) Avail: NTIS HC A02/MF A01

A shallow solar pond is a black-bottomed body of water (4 inches) which will get hot in the sun. In the current applications the water is covered with a transparent plastic layer to prevent heat loss by evaporation, and another glazing is mounted above with an insulating dead air space in between to provide a greenhouse effect to trap the solar heat. Until used, the hot water is stored in a reservoir with sufficient insulation to prevent appreciable heat losses. ERA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N77-14612 British Library Lending Div., Boston Spa (England).
DIRECTION OF NO SUB x RESTRICTION AND THE PRESENT STATUS OF NO SUB x REDUCTION TECHNOLOGIES
K. Sakashita Nov. 1976 28 p refs Transl. into ENGLISH from Nihon Gasu Kyokai-Shi (Japan), v. 27, no. 2; 1974 p 18-27
(BLL-RTS-9503) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL overseas, 15 European or 60 UK BLL photocopy coupons

The environmental standards concerning NO2, and NOx exhaust standards for attaining those environmental standards are reviewed from the viewpoint of a city gas enterprise. Additionally the problem of overall amount restrictions, which was mentioned as an extreme NOx countermeasure, is touched upon. Finally, the results of an investigation to determine what extent NOx reduction was achieved through the application of existing NOx reducing technology are described, using as much data as it was possible to collect. Author

N77-14613# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).
AIR POLLUTION. SECOND FOLLOW-UP REPORT: AIR POLLUTION PILOT STUDY
24 Sep. 1976 42 p
(Rept-50) Avail: NTIS HC A03/MF A01

The second follow-up report on the 15 Air Pollution Pilot Study Recommendations is to concentrate on the status of NAC NATO/CCMS recommendations in cities with populations over 600,000 in 1976. It also can be compared to responses to the 1975 survey and follow-up report to evaluate changes in air pollution activities in the last year. The recommendations include general assessment of air pollution, standard-setting, establishment of air quality monitoring systems and suitable systems for retrieval and storage of data, employment of recognized reference methods for monitoring and institution of uniform procedures for conducting emissions inventories. Author

N77-14614*# Business and Technological Systems, Inc., Seabrook, Md.
URBAN AIR QUALITY ESTIMATION STUDY, PHASE 1 Final Report
John M. Diamante, Thomas S. Englar, Jr., and Andrew H. Jazwinski Jan. 1976 105 p refs
(Contract NAS1-13764)
(NASA-CR-145097; BTS-TR-76-28) Avail: NTIS HC A06/MF A01 CSCL 13B

Possibilities are explored for applying estimation theory to the analysis, interpretation, and use of air quality measurements in conjunction with simulation models to provide a cost effective method of obtaining reliable air quality estimates for wide urban areas. The physical phenomenology of real atmospheric plumes from elevated localized sources is discussed. A fluctuating plume dispersion model is derived. Individual plume parameter formulations are developed along with associated a priori information. Individual measurement models are developed. Author

N77-14615*# Utah Univ., Salt Lake City. Dept. of Mechanical and Industrial Engineering.
THE SUBJECTIVE EVALUATION OF NOISE FROM LIGHT AIRCRAFT Final Report
Kevin P. Shepherd Washington NASA Dec. 1976 39 p refs

(Grant NsG-1160)
(NASA-CR-2773; UTEC-ME-75-159) Avail: NTIS HC A03/MF A01 CSCL 13B

A study was conducted in which subjects evaluated the sounds of a light aircraft and a motorcycle. Particular emphasis was placed on examining the duration of the sounds. Thirty subjects gave annoyance ratings to a total of 50 sounds, with peak levels between 65 and 85dB(A). It was found that aircraft and motorcycles have differing optimum duration corrections. The conventional duration correction used in the calculation of EPNL is far from being the optimum for light aircraft. Author

N77-14616# Naval Research Lab., Washington, D.C. Space Science Div.

EVALUATION OF A PASSIVE MICROWAVE TECHNIQUE FOR THE MEASUREMENT OF OIL FILM THICKNESS IN A TEST TANK ENVIRONMENT

James P. Hollinger and James E. Kenney Apr. 1976 53 p refs
(NRL Proj. G01-08)
(AD-A026829; NRL-MR-3308) Avail: NTIS HC A04/MF A01 CSCL 13/2

The performance testing and evaluation of various oil slick containment and cleanup devices, such as booms and skimmers, requires an accurate determination of the distribution and thickness of the oil being contained or recovered from the water surface. The results of a series of airborne measurements of marine oil spills, sponsored by the U.S. Coast Guard, have demonstrated the remote determination of oil slick thickness using a multifrequency passive microwave technique. The objective of the present investigation is to develop and apply this technique to the measurement of oil film thicknesses in a test tank environment for the quantization of performance data in oil cleanup and containment device evaluation tests. GRA

N77-14617# Louisiana State Univ., Baton Rouge.

BIODEGRADATION OF CELLULOSIC SUBSTRATES Final Report

Samuel P. Meyers 1 Jun. 1976 16 p refs
(Contract N00014-69-A-0211-0006; NR Proj. 306-087)
(AD-A026401) Avail: NTIS HC A02/MF A01 CSCL 13/2

Mechanisms for accelerated biodegradation of cellulosic substrates have been examined, especially analyses and optimization of pre-treatment of the fiber prior to microbial digestion. Methodology has been developed for enumeration of cellulolytic microorganisms and quantitative evaluation of cellulose transformation in the environment. Enzymatic activities of specific microorganisms have been studied, along with effect of specific pollutants on in situ processes, particularly cellulose turnover. PCBs present in cellulosic wastes have been analyzed and schematics proposed for their removal. Overall data suggest that selected physical/biodegradative techniques can be developed to accelerate rates of cellulose decomposition in the aqueous environment. GRA

N77-14618# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

SOLID WASTE MANAGEMENT: TOMORROW'S ALTERNATIVES IN THE URBAN-RURAL ENVIRONMENT M.S. Thesis

Ronald J. Weeden 1975 172 p refs
(AD-A026264; AFIT-CI-76-44) Avail: NTIS HC A08/MF A01 CSCL 13/2

Solid wastes collection and disposal problems are enormous and inadequacies are not only polluting our land, air, and water, but are precipitating social, economic, and political problems as well. It is assumed that any design for solid waste management must include resource recovery as an integral part of the system, but only within the limits of cost/benefit advantages and, equally important, within the limits of developing markets for recovered materials. Viable alternatives are documented for solving the immediate problem and integrating the capability for conserving precious resources by enhancing the following objectives: (1) Improve efficiencies; (2) Enhance satisfaction; (3) Increase local knowledge and information; and, (4) Economically recover and process materials. GRA

N77-14619# Life Systems, Inc., Cleveland, Ohio.

DEVELOPMENT OF ORGANIC SOLUTE AND TOTAL ORGANIC CARBON MONITORS Annual Report, 30 Jun. 1975 - 29 Jun. 1976

R. J. Davenport and R. A. Wynveen Jun. 1976 81 p refs
(Contract DAMD17-75-C-5070)
(AD-A026629; LSI-ER-285-3) Avail: NTIS HC A05/MF A01 CSCL 14/2

The Electrochemical Organic Content (EOC) Analyzer and three New Technology Analyzers were conceptually designed and evaluated. The four analyzers are feasible approaches to monitoring organic solute concentrations in the effluent of the Water Processing Element (WPE) of the Medical Unit, Self-Contained, Transportable (MUST) Army field hospital. The New Technology Analyzers are the Electrochemical Total Organic Carbon (TOC) Analyzer, the Electrochemical Chemical Oxygen Demand (COD) Analyzer and the Electrochemical Total Oxygen Demand (TOD) Analyzer. The feasibility of a laboratory breadboard version of the EOC Analyzer was experimentally demonstrated. Results, conclusions and recommendations are presented. GRA

N77-14620# New Mexico Univ., Albuquerque. Eric H. Wang Civil Engineering Research Facility.

DEVELOPMENT OF HIGH PRESSURE LIQUID CHROMATOGRAPHIC TECHNIQUES Final Report

Edward A. Walters May 1976 48 p refs
(Contract F29601-74-C-0030)
(AD-A026899; CERF-EE-3; AFWL-TR-75-234) Avail: NTIS HC A03/MF A01 CSCL 14/2

This is an interim report on a continuing study of the application of High Pressure Liquid Chromatographic (HPLC) techniques to water pollution problems. Reported herein are developmental data on three new detection systems; an ultrasonic velocity detector, a beta-induced luminescence detector, and a specific solid-state silver-ion detector. Preliminary results of work on separations in natural waters and in sewage effluents using HPLC techniques and an extensive literature survey on HPLC are also included. GRA

N77-14621# Naval Air Propulsion Test Center, Trenton, N.J. Propulsion Technology and Project Engineering Dept.

DISCUSSION OF AIRCRAFT AIR POLLUTION LEGISLATION AND NAVAL AIRCRAFT OPERATIONS Final Report

A. F. Klarman and Richard J. Skeba Jun. 1976 26 p refs
(AD-A026176; NAPTC-PE-83) Avail: NTIS HC A03/MF A01 CSCL 13/2

Information on Laws, Executive Orders and Environmental Protection Agency (EPA) Regulations which could have an effect on naval air operations was surveyed and summarized. Specific analysis of Naval air operations was performed in conformance with the EPA Standards for aircraft and aircraft engines and also taking into consideration differences between commercial and Naval air operations. The establishment of engine emission goals to be incorporated into new engine development programs was recommended. Author (GRA)

N77-14622# Environmental Protection Agency, Washington, D.C. Effluent Guidelines Div.

DEVELOPMENT DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES AND NEW SOURCE PERFORMANCE STANDARDS FOR THE FISH MEAL, SALMON, BOTTOM FISH, CLAM, OYSTER, SARDINE, SCALLOP, HERRING, AND ABALONE SEGMENT OF THE CANNED AND PRESERVED FISH AND SEAFOOD PROCESSING INDUSTRY POINT SOURCE CATEGORY Final Report

Elwood H. Forsht Sep. 1975 503 p refs
(PB-256840/0; EPA-440/1-75-041-a) Avail: NTIS HC A22/MF A01 CSCL 13B

The findings of an extensive study of the fish meal, salmon, bottom fish, clam, oyster, sardine, scallop, herring, and abalone segment of the canned and preserved fish and seafood processing industry of the United States were presented to develop effluent limitations for point source and new source standards of performance. Effluent limitations are set forth for the degree of effluent reduction. Author

N77-14623# North Carolina Water Resources Research Inst., Raleigh.

EVALUATION OF SOIL SYSTEMS FOR LAND DISPOSAL OF INDUSTRIAL AND MUNICIPAL EFFLUENTS
B. L. Carlile and J. A. Phillips Jul. 1976 77 p refs
(Contract DI-14-31-0001-5033)
(PB-257093/5; UNC-WRRI-76-118; W76-11774; OWRT-A-071-NC(2)) Avail: NTIS HC A05/MF A01 CSCL 13B

The suitability of soils of North Carolina for application of industrial and municipal wastes was studied. Design loadings varied considerably, including hydraulic loadings of one inch per week on the Piedmont sites and up to four inches per week on the rapidly drained sands of the Coastal Plain. Organic loadings which could be successfully utilized on each site ranged from about 1100 lb/a/wk to about 4000 lb/a/wk of total oxygen demanding material, again with the lower rates required on the Piedmont soils. Of the sites investigated, salt problems were responsible for more operational problems than any other design parameter. GRA

N77-14624# Geological Survey, Bay Saint Louis, Miss. Gulf Coast Hydroscience Center.
UNSTEADY-STATE WATER-QUALITY MODEL Interim Report
Daniel P. Bauer and James P. Bennett Aug. 1976 116 p refs
(PB-256336/9; USGS-WRD-WRI-76-054) Avail: NTIS HC A06/MF A01 CSCL 13B

The unsteady state water quality program is based on a one dimensional mathematical model which predicts the stream response characteristics from waste source inputs. Variables which are predicted include dissolved oxygen and biochemical-oxygen demand. A convolution approach is used to solve the dissolved oxygen balance and biochemical oxygen demand equations. Longitudinal dispersion is, however, not considered in the program equations. A numerical integration technique is used for the solution of the model differential equations. The model formulation allows for unsteady state conditions (varying flow rate and concentration) for waste and stream. GRA

N77-14625# TRW Transportation and Environmental Operations, Redondo Beach, Calif.
AN IMPLEMENTATION PLAN FOR SUSPENDED PARTICULATE MATTER IN THE LOS ANGELES REGION. TECHNICAL SUPPORT DOCUMENTS. 1: ANALYSIS OF AIR MONITORING DATA. 2: EMISSION INVENTORIES AND PROJECTIONS. 3: AIR QUALITY - EMISSION LEVEL RELATIONSHIP. 4: ALTERNATIVE EMISSION CONTROL MEASURES
K. W. Crawford and J. C. Trijonis Mar. 1976 570 p refs Sponsored by EPA
(PB-257017/4) Avail: NTIS HC A24/MF A01 CSCL 13B

A study was conducted to develop a particulate implementation plan for the Metropolitan Los Angeles Air Quality Control Region. Control strategies were formulated which produce substantial reductions in suspended particulate levels and the impact of these strategies in 1977 and 1980 was evaluated. Because of the severity of the Los Angeles particulate problem and because of significant background particulate levels, the strategy for standard attainment is of a very drastic nature. Other less drastic control plans for actual implementation are proposed. GRA

N77-14626# Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
RESIDUAL MANAGEMENT BY LAND DISPOSAL
Wallace H. Fuller Jul. 1976 280 p refs Presented at Proc. of the Hazardous Waste Res. Symp., Tucson, Ariz. 2-4 Feb. 1976
(Contract EPA-804330)
(PB-256768/3; EPA-600/9-76-015) Avail: NTIS HC A13/MF A01 CSCL 13B

A research symposium was held to exchange information on the land disposal of municipal and hazardous wastes. Papers were presented and compiled into a report on the following topics: (1) case studies of actual and potential environmental impact from land disposal of hazardous wastes; (2) technology of preventing adverse environmental impact; (3) selection of disposal sites to minimize adverse impact; (4) ameliorating damages at existing disposal sites and suggested modification of future sites and wastestreams; (5) identification of pollution potential of selected industrial solid wastes, and (6) special disposal problems. GRA

N77-14627# Envirex, Inc., Milwaukee, Wis. Environmental Sciences Div.
DEVELOPMENT OF A MOBILE TREATMENT SYSTEM FOR HANDLING SPILLED HAZARDOUS MATERIALS Final Report
Mahendra K. Gupta Cincinnati EPA Jul. 1976 86 p refs
(Contract EPA-68-01-0099)
(PB-256707/1; EPA-600/2-76-109) Avail: NTIS HC A05/MF A01 CSCL 13B

The results of a laboratory test program undertaken to define the treatment processes for the development of a modular transportable treatment unit for an on-site handling of spilled hazardous materials in aqueous solutions are reported. Nine materials evaluated for treatment by chemical reaction, clarification and activated carbon adsorption were: acetone cyanohydrin, acrylonitrile, ammonia, chlorinated hydrocarbons, chlorine, methanol, phenol, tetraethyllead (TEL) and tetramethyllead (TML). Several additional materials listed were evaluated for treatment feasibility by reverse osmosis. The results of the laboratory tests indicated that the unit treatment processes of chemical reaction, flocculation, sedimentation, granular media filtration and activated carbon adsorption form the most suitable and versatile system for an on site removal and treatment of hazardous materials. GRA

N77-14628# Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.
HYDRAULIC MODEL STUDIES OF MECHANICAL MIXING DEVICES IN STRATIFIED LAKES Final Technical Completion Report, 1 Jul. 1975 - 30 Jun. 1976
P. M. Moretti and D. K. McLaughlin 1976 110 p refs Sponsored by Interior Dept.
(PB-256709/7; ER-76-ME-2; W76-11495; OWRT-A-064-OKLA(1)) Avail: NTIS HC A06/MF A01 CSCL 13B

The effectiveness of devices for artificially destratifying lakes was analyzed. A criterion for the effectiveness of mixing was selected. This criterion was applied to a number of variations of mechanical mixing devices to indicate trends in optimization of designs. Experiments were performed in a vertically exaggerated scale model of Ham's Lake. Destratification was accomplished by a jet of water from two different sizes of propellers in different configurations (shrouded, skirted, and free; at two depths; and with a deflector) mixing the top water with the bottom water. Data taken from the experiments included density profiles as a function of time. The data were analyzed determining the change of the stability index with time. GRA

N77-14629# Wisconsin Univ., Madison. Dept. of Chemistry.
AN INVESTIGATION OF THREE METHODS FOR THE DETERMINATION OF SUB-MICROMOLAR ION CONCENTRATIONS IN WATER
W. J. Blaedel, G. W. Schieffer, R. A. Niemann, and D. E. Dinwiddie Jun. 1976 53 p refs
(Contracts DI-14-31-0001-4050; DI-14-31-0001-5050)
(PB-256579/4; W76-11331; OWRT-A-053-WIS(5); TR-76-07) Avail: NTIS HC A04/MF A01 CSCL 13B

Two methods were studied for the sampling, concentration, or determination of trace metal ions at submicromolar levels. (1) Trace ions in a sample donor solution are concentrated by loading upon a pellicular ion exchanger, and these are eluted or stripped into an acceptor solution at an enhanced concentration level so that they can be more easily measured. (2) With sample solution flowing through two tubular electrodes in series, trace metal ions are deposited cathodically at the upstream electrode, and then stripped off by scanning the upstream electrode toward anodic potentials. With the proper control of conditions, and with the downstream electrode maintained at a constant cathodic potential, collector currents due to metal ions stripped from the upstream electrode are measured at the downstream electrodes and used for estimating the trace metal ion concentration in the original sample solution. GRA

N77-14630# Battelle Pacific Northwest Labs., Richland, Wash.
PRECIPITATION SCAVENGING OF FOSSIL-FUEL EFFLUENTS Final Report, 24 Jun. 1974 - 28 Nov. 1975
M. Terry Dana, Dennis R. Drewes, Donald W. Glover, and Jeremy M. Hales Jun. 1976 106 p refs
(Contract EPA-68-02-1729)
(PB-256649/5) Avail: NTIS HC A06/MF A01 CSCL 13B

A numerical model for predicting the precipitation scavenging of reactive pollutants from power plant plumes was developed. The model, called SMICK (Scavenging Model Incorporating Chemical Kinetics), calculates collection, liquid phase chemical reaction, and desorption, if any, of multiple plume-bound pollutants as they interact with falling raindrops and are ultimately deposited on the surface. Calculations for any specific aqueous phase kinetics mechanism are performed with the model by expressing the mechanism in appropriate sub-routine form. The model was tested against field experiment data. GRA

N77-14631# ADAPT Service Corp., Reading, Mass.
EFFECT OF MECHANICAL COOLING DEVICES ON AMBIENT SALT CONCENTRATION Final Report, Feb. - Sep. 1975
Herbert E. Hunter Apr. 1976 142 p refs
(Contract EPA-68-03-2176)
(PB-256679/2; ADAPT-75-8; EPA-600/3-76-034) Avail: NTIS HC A07/MF A01 CSCL 13B

An analysis of the airborne salt concentration data collected during a demonstration of the salt water mechanical cooling devices at a nuclear power plant is presented. The data were analyzed using a family of empirical analysis programs which are based on the concept that empirical analysis is preceded by the development of an optimal (in the Karhunen Loeve sense) representation of the data. The analysis presented shows that the increase in the background salt concentration due to the cooling tower was less than the measurement accuracy of approximately three to five micrograms per cubic meter. GRA

N77-14632# Environmental Monitoring and Support Lab., Research Triangle Park, N.C. Statistical and Technical Analysis Branch.
CODING MANUAL FOR THE QUALITY ASSURANCE PERFORMANCE AUDIT FOR AEROMETRIC DATA
Raymond C. Rhodes and Donald H. Fair Jan. 1976 24 p refs
(PB-256688/3; EPA-600/4-76-006) Avail: NTIS HC A02/MF A01 CSCL 13B

Appendix A of 'Guideline Document OAQPS 1.2020, 'Guidance for Decentralization and Continued Operation of the NASN', provided instructions for performing quality assurance performance audits for the National Air Surveillance Network. This coding manual furnishes detailed coding instructions to those who perform the audits and record the data for transmittal to EPA. GRA

N77-14633# Oklahoma State Univ., Stillwater.
AUTOMATED POND WATER TREATMENT UNIT Completion Report, 1 Jan. 1975 - 30 Jun. 1976
Charles E. Rice, James E. Garton, and Larry D. Jarrell 1976 21 p ref Sponsored by Interior Dept.
(PB-256570/3; W76-11340; OWRT-A-060-OKLA(1)) Avail: NTIS HC A02/MF A01 CSCL 13B

An automated pond water treatment unit was designed, constructed and evaluated. It was designed as an exterior unit to be located in the vicinity of a pond or lake. The unit was self contained and furnished filtered and chlorinated water under pressure. The unit consisted of a pond water pump, chlorine and alum solution containers with metering pumps, a sand filter, a time clock and solenoid for backflushing, storage for treated water and a water pressure pump and storage tank. The sand filter was an upflow type which permitted the floc to settle out and be removed by backflushing. The pond water pump had a capacity of nine gallons per minute (34 liters per minute) and the pressure pump a capacity of about eight gallons per minute (30 liters per minute). GRA

N77-14634# Exxon Research and Engineering Co., Linden, N.J. Products Research Div.
COLLECTION EFFICIENCIES OF STACK SAMPLING SYSTEMS FOR VANADIUM EMISSIONS IN FLUE GASES Final Report, Jul. 1974 - Jun. 1975
H. Lawrence Goldstein and C. W. Siegmund Apr. 1976 167 p refs
(Contract EPA-68-02-1748)
(PB-256399/7; EPA-600/2-76-096) Avail: NTIS HC A08/MF A01 CSCL 13B

An experimental program was conducted to measure and compare the efficiency of two stack sampling systems to collect vanadium-bearing particulate emissions in flue gas. To evaluate collection efficiency, an extensive factorial study was carried out in a 50 hp four-pass firetube boiler burning typical residual fuel oils. In each test the sampling systems were operated simultaneously in the stack to collect the vanadium-bearing particulate emissions. Three residual fuel oils were tested. The results show that vanadium collection efficiency depends on combustion residence time and sampling system. GRA

N77-14635# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT: SEVERITY OF STATIONARY AIR POLLUTION SOURCES-A SIMULATION APPROACH Final Report, Jun. 1975 - May 1976
E. C. Eimutis, B. J. Holmes, and L. B. Mote Jul. 1976 133 p refs
(Contract EPA-68-02-1874)
(PB-256310/4; MRC-DA-543; EPA-600/2-76-032-e) Avail: NTIS HC A07/MF A01 CSCL 13B

The results of a study simulating the establishment of the severity of stationary air pollution sources are given. The potential environmental impact of an emission source is determined from the source severity (the ground level concentration contribution of pollutants relative to some potentially hazardous concentration of the same species). The frequency distribution of the severity of well-documented source types is examined deterministically. A statistical approach is required to simulate the frequency distribution of the severity of source types that are complex or involve a large number of emission points in order to ultimately assess such sources. A Monte Carlo simulation technique is described, together with efficient algorithms for fitting the inverse Weibull, gamma, normal, and log-normal cumulative density functions. Significant correlation is demonstrated between deterministic and simulated severity results using coal fired steam/electric utilities as an example. GRA

N77-14636# Syracuse Univ. Research Corp., N.Y. Center for Chemical Hazard Assessment.
INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: MERCAPTOBENZOTHIAZOLES Final Report
Joseph Santodonato, Leslie N. Davis, Philip H. Howard, and Jitendra Saxena Jun. 1976 160 p refs
(Contract EPA-68-01-3128)
(PB-256662/8; TR-76-502; EPA-560/2-76-006) Avail: NTIS HC A08/MF A01 CSCL 13B

The potential environmental hazard from the commercial use of 2-mercaptobenzothiazoles (MBT) is reviewed. Most of the mercaptobenzothiazoles are consumed as rubber accelerators in vulcanization processes, although the sodium salt of MBT is used as a corrosion inhibitor in water-based cooling systems. Information on physical and chemical properties, production methods and quantities, commercial uses and factors affecting environmental contamination, as well as information related to health and biological effects are studied. GRA

N77-14637# Environmental Technical Applications Center, Scott AFB, Ill.
AN AIR POLLUTION ASSESSMENT OF HYDROGEN FLUORIDE
Richard W. Fisher Mar. 1976 38 p refs
(AD-A027458; USAFETAC-7785) Avail: NTIS HC A03/MF A01 CSCL 07/4

The purpose of this report is to estimate the diffusion characteristics and downwind concentrations of hydrogen fluoride (HF) after it is released from an airplane. The author conducted an exhaustive search of USAFETAC's in-house technical library to determine a method or methods adaptable to this problem. GRA

N77-14638# Exxon Research and Engineering Co., Linden, N.J.
EVALUATION OF POLLUTION CONTROL IN FOSSIL FUEL CONVERSION PROCESSES Final Report, Jun. 1972 - Jan. 1976
E. M. Magee Apr. 1976 306 p refs
(Contract EPA-68-02-0629)
(PB-255842/7; EXXON/GRU.16DJ.76; EPA-600/2-76-101)
Avail: NTIS HC A14/MF A01 CSCL 21D

The review gives an overview of work, between June 1972 and January 1976, on various environmental aspects of fossil fuels. Details of this work are presented in 14 reports published during this same period. The details include potential pollutants in fossil fuels; quantities of solid, liquid, and gaseous effluents from coal treatment and conversion to gaseous and liquid fuels; and an analytical test plan for coal conversion systems. The overview report discusses commonality and differences in the reviewed processes with emphasis on factors which might affect the environment when the processes are in commercial use. Due to the lack of a sufficient data base, data and research and development needs are also addressed. GRA

N77-14639# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
TEST PLAN FOR AIRCRAFT RUNUP NOISE PENALTY EVALUATION Final Report
Sanford Fidell Mar. 1976 39 p refs
(Contract F33615-75-C-5044; AF Proj. 7231)
(AD-A026209; BBN-2941; AMRL-TR-75-110) Avail: NTIS HC A03/MF A01 CSCL 01/5

This report outlines a test plan for conducting a social survey to determine whether community response to noise from military aircraft operations differs significantly between noise from flight operations and noise from ground runup (maintenance) operations. The report includes discussion of the methodology and rationale for the survey as well as sample telephone and mail questionnaires. Author (GRA)

N77-14640# Fluidyne Engineering Corp., Minneapolis, Minn.
PARTICULATE SAMPLING STRATEGIES FOR LARGE POWER PLANTS INCLUDING NONUNIFORM FLOW Final Report, Jun. 1973 - Dec. 1975
H. A. Hanson, R. J. Davini, J. K. Morgan, and A. A. Iversen Research Triangle Park, N. C. Environ. Sci. Res. Lab., Research Triangle Park, N. C. Jun. 1976 371 p refs
(Contract EPA-68-02-1244)
(PB-257090/1; EPA-600/2-76-170) Avail: NTIS HC A16/MF A01 CSCL 13B

Results are given of a study to determine the effects that various geometric ducting configurations have on the flow profiles and the distribution of particulate in ducting systems of large (> 100 MW) power plants. The program included both laboratory model studies and field testing at large power plants. The measurement of total volumetric flow and particulate emissions at less than full operating capacity was also investigated. The results of flow angularity measurements in large stacks at typical sample port locations, including downstream of induced draft fans, are similarly discussed. Special attention was given to the aerodynamic effects of S-tube/sampling probe interference on velocity measurements with an S-tube in EPA Stack Emissions Measurement Reference Methods 2 and 5. A computerized technique was used to determine the effectiveness of various equal area sampling strategies in providing accurate measurements of three emission parameters: average particulate concentration, total volumetric flow rate, and total emissions. Numerous typical and atypical velocity and particulate concentration profiles were studied. Sampling strategy recommendations are presented. GRA

N77-14641# Hydrocomp, Inc., Palo Alto, Calif.
MODELING NONPOINT POLLUTION FROM THE LAND SURFACE Final Report
Anthony S. Donigian, Jr. and Norman H. Crawford Athens, Ga. Environ. Res. Lab. Jul. 1976 294 p refs
(Grant EPA-R-803315-01-0)
(PB-257089/3; EPA-600/3-76-083) Avail: NTIS HC A13/MF A01 CSCL 13B

Development and initial testing of a mathematical model to continuously simulate pollutant contributions to stream channels from nonpoint sources is presented. The Nonpoint Source Pollutant Loading (NPS) Model is comprised of subprograms to represent the hydrologic response of a watershed, including snow accumulation and melt, and the processes of pollutant accumulation, generation, and washoff from the land surface. The simulation of nonpoint pollutants from both pervious and impervious areas is based on sediment as a pollutant indicator. The calculated sediment washoff is multiplied by user-specified 'potency factors' that indicate the pollutant strength of the sediment for each pollutant simulated. Both urban and rural areas can be simulated. Initial testing of the NPS Model was performed on three urban watersheds in Durham, North Carolina; Madison, Wisconsin; and Seattle, Washington. GRA

N77-14642# General Electric Co., Santa Barbara, Calif. TEMPA Center for Advanced Studies.
MONITORING GROUNDWATER QUALITY: METHODS AND COSTS Final Report
Lorne G. Everett, Kenneth D. Schmidt, Richard M. Tinlin, and David K. Todd Las Vegas, Nev. Environ. Monitoring and Support Lab., Las Vegas, Nev. May 1976 152 p refs
(Contract EPA-68-01-0759)
(PB-257133/9; GE75TMP-69; EPA-600/4-76-023) Avail: NTIS HC A08/MF A01 CSCL 13B

Various groundwater monitoring methods are described. A generalized cost breakdown of the major economic factors is provided for each method. All possible groundwater-related measuring techniques applicable at the land surface, topsoil, vadose zone and zone of saturation are presented. Each monitoring method is described, referenced and illustrated. Estimates of itemized capital and operational costs are given. The material is presented for in-depth reference purposes without recommendation for least-cost techniques, a least-cost mix of groundwater monitoring approaches, or an optimal information system. GRA

N77-14643# Industrial Environmental Research Lab., Research Triangle Park, N. C.
PROCEEDINGS OF THE STATIONARY SOURCE COMBUSTION SYMPOSIUM. VOLUME 3: FIELD TESTING AND SURVEYS Environmental Protection Technology Series
1976 476 p refs Presented at Atlanta, 24-26 Sep. 1975
(PB-257146/1; EPA-600/2-76-152-c-Vol-3) Avail: NTIS HC A21/MF A01 CSCL 13B

Contents: The effect of combustion modification on pollutants and equipment performance of power generation equipment; Analysis of gas-, oil-, and coal-fired utility boiler test data; Influence of combustion modifications on pollutant emissions from industrial boilers; Systems evaluation of the use of low-sulfur western coal in existing small- and intermediate-sized boilers; A survey of emissions control and combustion equipment data in industrial process heating; POM (Polycyclic Organic Matter) and particulate emissions from small commercial stoker-fired boilers; Concluding remarks. GRA

N77-14644# Rohr Industries, Inc., Chula Vista, Calif.
SOUND ATTENUATION KIT FOR DIESEL-POWERED BUSES Final Report, Feb. 1974 - Feb. 1975
James C. Berry and David L. Overgard Jun. 1976 235 p
(Contract DOT-TSC-714)
(PB-256828/5; DOT-TSC-OST-76-5) Avail: NTIS HC A11/MF A01 CSCL 13F

A project was initiated to assess, demonstrate and document the noise reduction potential of optimized commercially available exhaust, intake, and fan subsystems on a typical diesel powered city bus. These subsystems were to be retrofitable designs in current vehicle fleets while maintaining public safety and established vehicle exhaust emission regulations. A reference for manufacturers, owners, and operators to consult for recommendations or instructions on installing a proven noise reduction kit is provided. The causes of diesel powered bus noise are studied, and an effective means for its reduction is discussed. Appendixes give standard noise measurement procedures, acoustic and performance test data on the various design configurations, and service information on sound attenuation kits. GRA

N77-14645# Research Triangle Inst., Research Triangle Park, N.C.
SECOND ENVIRONMENTAL ASPECTS OF FUEL CONVERSION TECHNOLOGY SYMPOSIUM Final Report

Franklin A. Ayer, comp. Jun. 1976 389 p refs Conf. Proceedings held at Hollywood, Florida, 15-18 Dec. 1975
(Contract EPA-68-02-1325)
(PB-257182/6; EPA-600/2-76-149) Avail: NTIS HC A17/MF A01 CSCL 13B

The main objective was to review and discuss environmentally related information in the field of fuel conversion technology. Specific topics were environmental problem definition, process technology, control technology, and process measurements. GRA

N77-14646# Research Triangle Inst., Research Triangle Park, N.C.
DEVELOPMENT STRATEGY FOR POLLUTANT DOSIMETRY Final Report
J. W. Harrison, P. A. Lawless, D. E. Gilbert, and J. H. White Research Triangle Park, N. C. Environ. Sci. Res. Lab. Feb. 1976 195 p refs
(Contract EPA-68-02-1731)
(PB-256910/1; EPA-600/2-76-034) Avail: NTIS HC A09/MF A01 CSCL 14B

The needs of epidemiologists for personal pollutant dosimeters are investigated. Pollutant sensing principles are identified for developing instruments to meet those needs. The impact of mechanical and electronic miniaturization techniques on the options selected are projected. The cost benefits of active vs. passive atmospheric sampling are assessed and applied to each candidate sensor. Devices for measuring ozone, sulfur dioxide, and nitrogen dioxide are considered. Author

N77-14647# Pacific Northwest Environmental Research Lab., Corvallis, Ore.
WATER QUALITY CRITERIA RESEARCH OF THE US ENVIRONMENTAL PROTECTION AGENCY
Jul. 1976 194 p refs Presented at the 26th An. Meeting of the AIBS on Marine, Estuarine and Fresh Water Quality, Corvallis, Oreg., Aug. 1975; sponsored by EPA
(PB-257091/9; EPA-600/3-76-079) Avail: NTIS HC A09/MF A01 CSCL 08A

A cross sectional representation of the broad base ecological effects research programs is presented. Microbial and abiotic degradation processes, the problem of trace metals, the effects of toxic organics, and the feasibility of new stress-measuring methodologies in the marine environment are studied. The transport and biological modeling capabilities of the laboratories, cold climate aquatic biology, lake trophic states in the eastern United States, and the impact of toxic substances on freshwater systems are also discussed. GRA

N77-13978# Department of Transportation, Washington, D.C.
CLIMATIC IMPACT
Alan J. Grobecker *In* Md. Univ. Air Transportation for the 1980's, Jun. 1976 p 53-114 refs Presented at College Park, Md. 3 Feb. 1976 (For primary document see N77-13975 05-01)
Avail: NTIS HC A17/MF A01

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N77-14648 British Library Lending Div., Boston Spa (England).
SOLAR ACTIVITY AND THE EPOCH OF ARCTIC WARMING
N. I. Tyabin and B. A. Sleptsov-Shevlevich [1976] 35 p refs Transl. into ENGLISH from Arkt. Antarkt. Nauch.-Issled (Leningrad), vol. 325, 1974 p 4-23 In RUSSIAN and ENGLISH
(BLL-M-24799-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Accumulated hydrometeorological and geophysical data is used to study large scale climatic changes in the Northern Hemisphere. Topics discussed include the 22-year solar induced rhythms in the earth's pressure field, the secular cycle of solar activity and variations in magnetic disturbances, fluctuations in the pressure field of the Northern Hemisphere, variations in discharge of water through the Faroes Iceland Passage, long-term variations in the ice cover of the Arctic seas, and fluctuations in the level of the Caspian Sea. Author

N77-14649 Princeton Univ., N.J.
THE STRUCTURE AND DYNAMICS OF THE SOUTHERN HEMISPHERE STRATOSPHERE DURING LATE WINTER, 1973 Ph.D. Thesis
Dennis Lee Hartmann 1975 276 p
Avail: Univ. Microfilms Order No. 76-22598

The observed circulation of the global stratosphere is studied by using temperature data derived from radiance measurements taken by the Nimbus-5 meteorological satellite. The uppermost level of the data is at 0.2 mb (60 km). Daily height and horizontal velocity fields are computed from the analyzed temperature fields by employing the hydrostatic and geostrophic approximations. Radiative effects are included in thermodynamically derived vertical velocities. When applied to the satellite data, these tecnniques result in fields of the meteorological variables which are of sufficient quality to merit detailed dynamical analysis. The budgets of heat and momentum in the Southern Hemisphere are computed. The transport and budget of potential vorticity in the stratosphere of the Southern Hemisphere are computed and related to the transport of trace substances. The circulation is described in terms of synoptic maps, zonal cross-sections of means, variances and covariances and spectral analyses. Dissert. Abstr.

N77-14650*# Ocean Data Systems, Inc., Rockville, Md.
ATMOSPHERIC ANALYSIS AND PREDICTION MODEL DEVELOPMENT, VOLUME 1 Final Report
Phillip G. Kesel, Robert E. Wellck, Rodger A. Langland, and Howard L. Lewit Aug. 1976 117 p
(Contract NASw-2558)
(NASA-CR-149213) Avail: NTIS HC A06/MF A01 CSCL 04A

A set of hemispheric atmospheric analysis and prediction models was designed and tested. All programs were executed on either a 63 x 63 or 187 x 187 polar stereographic grid of the Northern Hemisphere. Parameters for objective analysis included sea surface temperature, sea level pressure, and twelve levels (from 1,000 to 100 millibars) of temperatures, heights, and winds. Stratospheric extensions (up to 10 millibars) were also provided. Four versions of a complex atmospheric prediction model, based on primitive equations, were programmed and tested. These models were executed on either the 63 x 63 or 187 x 187 grid, using either five or ten computational layers. The coarse-mesh (63 x 63) models were tested using real data for the period 21-23 April 1976. The fine-mesh (187 x 187) models were debugged, but insufficient computer resources precluded production tests. Preliminary test results for the 63 x 63 models are provided. Problem areas and proposed solutions are discussed. Author

N77-14651*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TERRESTRIAL KILOMETRIC RADIATION: 3-AVERAGE SPECTRAL PROPERTIES
Michael L. Kaiser and Joseph K. Alexander Nov. 1976 27 p refs Submitted for publication
(NASA-TM-X-71244; X-695-76-255; A-9831) Avail: NTIS HC A03/MF A01 CSCL 04A

A study is presented of the average spectral properties of terrestrial kilometric radiation (TKR) derived from observations made by radio astronomy experiments onboard the IMP-6 and RAE-2 spacecraft. As viewed from near the equatorial plane, TKR is most intense and most often observed in the 21-24 hr local time zone and is rarely seen in the 09-12 hr zone. The peak flux density usually occurs near 240 kHz, but there is evidence that the peak occurs at a somewhat lower frequency on the dayside. The frequency of the peak in the average flux spectrum varies inversely with increasing substorm activity as inferred from the auroral electrojet index (AE) from a maximum near 300 kHz during very quiet times to a minimum below 200 kHz during very disturbed times. The absolute flux levels in the 100-600 kHz TKR band increase significantly with increasing

AE. The average power associated with a particular source region seems to decrease rapidly with increasing source altitude.Author

N77-14652*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CAUSES OF RECURRENT GEOMAGNETIC STORMS
L. F. Burlaga and R. P. Lepping Dec. 1976 33 p refs Submitted for publication
(NASA-TM-X-71246; X-692-76-277) Avail: NTIS HC A03/MF A01 CSCL 04A

The causes of recurrent geomagnetic activity were studied by analyzing interplanetary magnetic field and plasma data from earth-orbiting spacecraft in the interval from November 1973 to February 1974. This interval included the start of two long sequences of geomagnetic activity and two corresponding corotating interplanetary streams. In general, the geomagnetic activity was related to an electric field which was due to two factors: (1) the ordered, mesoscale pattern of the stream itself, and (2) random, smaller-scale fluctuations in the southward component of the interplanetary magnetic field Bz. The geomagnetic activity in each recurrent sequence consisted of two successive stages. The first stage was usually the most intense, and it occurred during the passage of the interaction region at the front of a stream. These large amplitudes of Bz were primarily produced in the interplanetary medium by compression of ambient fluctuations as the stream steepened in transit to 1 A.U. The second stage of geomagnetic activity immediately following the first was associated with the highest speeds in the stream. Author

N77-14653*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE FOAMING OF LAVAS
John A. Okeefe and Wayne Walton (Northrop Services, Houston) Nov. 1976 12 p refs
(NASA-TM-X-71249; X-602-76-273) Avail: NTIS HC A02/MF A01 CSCL 08G

Foaming is of great practical and theoretical significance for volcanic processes on the earth, the moon, and perhaps the meteorite parent bodies. The theory of foams agrees with steelmaking experience to indicate that their presence depends on the existence of solutes in the lavas which reduce the surface tension, and are not saturated. These solutes concentrate at the surface, and are called surfactants. The surfactant responsible for the formation of volcanic ash was not identified; it appears to be related to the oxygen partial pressure above the lava. This fact may explain why lunar and meteoritic melts are not observed to foam. Experimental studies are needed to clarify the process. Author

N77-14654# Hebrew Univ., Jerusalem (Israel). Dept. of Atmospheric Sciences.
SOME USES IN SINGLE-STATION ANALYSIS OF PLANETARY BOUNDARY LAYER SIMILARITY THEORY
J. Neumann 1975 12 p refs
Avail: NTIS HC A02/MF A01

Similarity theory for the stationary neutral barotropic planetary boundary layer enables estimation for the components of the geostrophic wind as well as horizontal pressure distribution at and near the surface, and the friction velocity, for a single-station situation provided that: (1) there is pilot-balloon and surface pressure measurements, and (2) conditions conform reasonably well with the above theory. An example is given for the calculations. The effects on the above estimates of uncertainties in judging whether actual conditions conform with requirements of the theory are discussed. A kind of a criterion for accepting or for rejecting the estimates is proposed. Author

N77-14655*# Bell Aerospace Co., Buffalo, N.Y.
SATELLITE BORNE GRAVITY GRADIOMETER STUDY Final Report
E. Metzger, A. Jircitano, and C. Affleck Mar. 1976 62 p refs (Contract NAS5-20910)
(NASA-CR-144822; Rept-6413-950001) Avail: NTIS HC A04/MF A01 CSCL 08N

Gravity gradiometry is recognized to be a very difficult instrumentation problem because extremely small differential acceleration levels have to be measured, 0.1 EU corresponds to an acceleration of 10 to the minus 11th power g at two points 1 meter apart. A feasibility model of a gravity gradiometer is being developed for airborne applications using four modified versions of the proven Model VII accelerometers mounted on a slowly rotating fixture. Gravity gradients are being measured to 1.07 EU in a vertical rotation axis orientation. Equally significant are the outstanding operational characteristics such as fast reaction time, low temperature coefficients and high degree of bias stability over long periods of time. The rotating accelerometer gravity gradiometer approach and its present status is discussed and it is the foundation for the orbital gravity gradiometer analyzed. The performance levels achieved in a 1 g environment of the earth and under relatively high seismic disturbances, lend the orbital gravity gradiometer a high confidence level of success. Author

N77-14656*# Scientific Translation Service, Santa Barbara, Calif.
METEORITE ORIGIN OF THE PUCHEZH-KATUNKSK CRATER
L. F. Firsov Washington NASA Jul. 1976 25 p refs Transl. into ENGLISH from Geotektonika (Moscow), no. 2, 1965 p 106-118
(Contract NASw-2791)
(NASA-TT-F-17098) Avail: NTIS HC A02/MF A01 CSCL 08G

The geology of the zone of the Puchezh-Katunksk dislocations is described. Critical reviews on two recent hypotheses of their origin are presented. An hypothesis is prepared for the meteorite origin of the dislocation, whose zonal structure and morphology is reminiscent of the sloping crater of a surface explosion. A meteorite site's energy calculations are given and an estimate is made of the mass and dimensions of an asteroidal body whose explosion could produce the effect fixed in the dislocations. It is shown that the probability of a similar event is positive. The time of the event is determined from the stratigraphic data as the end of the Triassic to the beginning of the Jurassic. Author

N77-14657*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
METHODS FOR THE COMPUTATION OF DETAILED GEOIDS AND THEIR ACCURACY
Richard H. Rapp and Reiner Rummel Nov. 1975 42 p refs (Contract NAS6-2484)
(NASA-CR-141417; Rept-233) Avail: NTIS HC A03/MF A01 CSCL 08N

Two methods for the computation of geoid undulations using potential coefficients and 1 deg x 1 deg terrestrial anomaly data are examined. It was found that both methods give the same final result but that one method allows a more simplified error analysis. Specific equations were considered for the effect of the mass of the atmosphere and a cap dependent zero-order undulation term was derived. Although a correction to a gravity anomaly for the effect of the atmosphere is only about -0.87 mgal, this correction causes a fairly large undulation correction that was not considered previously. The accuracy of a geoid undulation computed by these techniques was estimated considering anomaly data errors, potential coefficient errors, and truncation (only a finite set of potential coefficients being used) errors. It was found that an optimum cap size of 20 deg should be used. The geoid and its accuracy were computed in the Geos 3 calibration area using the GEM 6 potential coefficients and 1 deg x 1 deg terrestrial anomaly data. The accuracy of the computed geoid is on the order of plus or minus 2 m with respect to an unknown set of best earth parameter constants. Author

N77-14658*# Scientific Translation Service, Santa Barbara, Calif.
GEOCHEMICAL AND ISOTOPIC STUDY OF A GRAVITY CORE OF THE SOUTHERN PACIFIC (ANTARCTIC OCEAN)
Gianni Cortecci and M. Bartelloni Washington NASA Jan. 1977 15 p refs Transl. into ENGLISH from Studio geochimico ed isotopico di una carota a gravita del pacifico meridionale (oceano artartico), Italian Society of Mineralogy and Petrography, Italy (Milan), v. 31, no. 1, 1975 p 199-207
(Contract NASw-2791)
(NASA-TT-F-17357) Avail: NTIS HC A02/MF A01 CSCL 08G

The oxygen isotopic profile of sulfate ions dissolved in the

pore water from a red clay sediment core collected in the Pacific Ocean is presented. The sulfate and organic matter and the pore water content profiles were also carried out. The lack of delta18 O(SO4(-2)) values higher than +9.5 per thousand proves the absence of a bacterial anaerobic reduction of sulfate in the sediments. This is due to a negligible content of organic matter in the sediment (from 0.0 to 0.6 per cent), the high molecular oxygen concentration in the bottom water (about 210 micromoles/kg) and, probably, the too low temperature of the bottom and pore waters (less than 1 C). Author

N77-14659# Lockheed Missiles and Space Co., Palo Alto, Calif.
INSTABILITY OF PARTICLE FLUXES IN THE PRESENCE OF AN IONOSPHERIC ELECTRICAL FIELD AND EXCITATION OF GEOMAGNETIC PULSATIONS
A. M. Liatskaia, V. B. Liatskii, and Iu. P. Maltsev 1976 6 p refs Transl. into ENGLISH from Geomagn. Aeron. (USSR), v. 16, no. 3, 1976 p 526-530
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Standing Alfven waves in the magnetosphere cause modulation of the dumped particle fluxes; the fluctuating fluxes of dumped particles in the presence of an external electrical field result in generation of an Alfven pulse in the ionosphere. The growth increment is calculated and conditions for self-excitation of the geomagnetic pulsations are determined. Author

N77-14660# Lockheed Missiles and Space Co., Palo Alto, Calif.
NONLINEAR MECHANISM FOR EQUILIBRIUM WAVINESS SPECTRUM FORMATION ON AN OCEAN SURFACE
V. A. Krasil'nikov and V. I. Pavlov 1976 3 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), v. 19, no. 5-6, 1976 p 880-882
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

An analysis is presented of two circumstances, which should be kept in mind in the problem of the build-up of an equilibrium spectrum on an ocean surface. Firstly, formation of a surface waviness spectrum occurs because of the effect of turbulent motion of the atmosphere in the near-surface layer on the surface. Secondly, surface waves possess a finite lifetime which can be determined by both dissipative and nonlinear effects. Depending on the frequency range in which the analysis is performed, some dissipation mechanism is predominant. Taking account of the finiteness of the surface wave lifetime results in somewhat of a variation in the conditions, permitted in lowest order perturbation theory, for the interaction between gravitational and capillary waves with the formation of capillary waves. Author

N77-14661# Lockheed Missiles and Space Co., Palo Alto, Calif.
GEOMAGNETIC PULSATIONS AND CHARGED PARTICLE FLUX MODULATION
A. M. Liatskaia, V. B. Liatskii, and Iu. P. Maltsev 1976 4 p refs Transl. into ENGLISH from Geomagn. Aeron. (USSR), v. 16, no. 3, 1976 p 566-569
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The connection between the degree of modulation of a dumped electron flux and the amplitude of geomagnetic pulsations with periods of 1 - 5 min is estimated. Transverse oscillations of the magnetic tube of force are accompanied by a change in the tube cross-section, which results in the appearance of substantial compressions and rarefactions of the magnetic field. The plasma in the tube experiences periodic heating and cooling, which results in variations of the particle flux in the tube with the period of its transverse oscillations. Variations of the particle flux at the ionosphere level depend essentially on the nature of the change in the pitch-angle distribution of the particles. Three cases are examined. They are distinguished by the nature of the change in the particle distribution function in the tube of force during its oscillation in the plane of the geomagnetic meridian, and also by the particle energy. The earth's magnetic field is considered a dipole. Author

N77-14662# National Oceanic and Atmospheric Administration, Boulder, Colo.
EQUIVALENT IONOSPHERIC CURRENT REPRESENTATIONS BY A NEW METHOD, ILLUSTRATED FOR 8-9 NOVEMBER 1969 MAGNETIC DISTURBANCES
Y. Kamide, H. W. Kroehl, M. Kanamitsu (Natl. Center for Atmospheric Res.), J. H. Allen, and S. I. Akasofu (Alaska Univ., Fairbanks) Apr. 1976 99 p refs
(Grant NSF DES-74-23832)
(PB-247916-55; UAG-55; NOAA-76051901) Avail: NTIS MF A01; HC available from National Climatic Center, Attn: Publications, Federal Bldg., Asheville, N. C. 28801. Subscription $25.20/year, single copy $1.60 this issue CSCL 04A

A data set of worldwide potential contours for ground magnetic perturbations resulting from a new method is described. Brief comments on other methods of representing magnetic activity and a discussion of the new method are presented. Plots at 10 minute intervals of magnetic perturbation vectors from 82 Northern Hemisphere observatories and the corresponding potential contours are presented. Also given are AU and AL index graphs for the 36-hour interval from 1200 UT November 8 to 2400 UT November 9, 1969. Appendices describe in detail the procedures used to determine a potential field from ground magnetic perturbations. GRA

N77-14663# Texas Instruments, Inc., Dallas. Equipment Group.
APPLICATION OF P-WAVE SPECTRAL MEASUREMENTS TO SHORT-PERIOD DISCRIMINATION
Robert L. Sax 31 Jul. 1975 56 p refs
(Contract F08606-75-C-0029; ARPA Order 2551)
(AD-A026226; TI-ALEX(01)-TR-75-08) Avail: NTIS HC A04/MF A01 CSCL 08/11

A method was developed for computing the displacement spectrum of earthquake dislocations and presumed explosions with greater accuracy. Measurements of corner frequencies and displacement amplitudes are considerably less ambiguous than those derived from conventional spectra. The relatively narrowband system response is apparently correctly accounted for in the equations for ground displacement, so that the displacement spectra are in principal valid up to 10 Hz. Presently, roundoff errors compounded by estimation errors due to the coda of the events limit the accuracy and validity of spectra at low frequencies less than approximately 1 Hz. It is anticipated that with further developments of the method, valid displacement spectra can be measured at lower frequencies. Discriminants between earthquakes and explosions were derived from measurements of corner frequency and displacement amplitudes taken from the spectra of events. These discriminants appeared to be at least as effective as other short-period spectral discriminants such as spectral splitting, spectral moments, and spectral magnitudes. The discriminants utilized measurements of spectra which are accurate only at frequencies greater than 1 Hz. Additional discriminants based on low frequency characteristics of the displacement spectra may be possible in the future when the accuracy of displacement spectral calculation is improved. GRA

N77-14664# ENSCO, Inc., Springfield, Va.
IMPROVED PROCEDURES FOR DETERMINING SEISMIC SOURCE DEPTHS FROM DEPTH PHASE INFORMATION Quarterly Report, 1 Dec. 1975 - 29 Feb. 1976
Edward Page Feb. 1976 17 p refs
(Contract F08606-76-C-0003; ARPA Order 2551)
(AD-A027179) Avail: NTIS HC A02/MF A01 CSCL 08/11

Seismic source depth determination techniques, developed under two previous contracts, were formulated into an automated analysis procedure. Differential travel time information, for several propagation modes relevant to the analysis, have been made accessible through 3 D curve fitting. Author (GRA)

N77-14665# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
A STELLAR SCINTILLOMETER FOR MEASUREMENT OF REFRACTIVE-TURBULENCE PROFILES
G. R. Ochs, Ting-i Wang, and F. Merrem Apr. 1976 26 p refs
(Contract F30602-74-F-0108)
(PB-257376/4; NOAA-TM-ERL-WPL-15) Avail: NTIS HC A03/MF A01 CSCL 04A

An optical system for measuring refractive-turbulence profiles in the atmosphere was described. The instrument measures the profile along the light path to a star by analyzing the scintillation

of the star by the atmosphere. The circuit diagram, computer program, and operating instructions for the instrument are included. GRA

N77-14666# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
RADIATION DATA REDUCTION PROCEDURES FOR SABRELINER, C-130, AND DC-6 AIRCRAFT DURING THE GARP ATLANTIC TROPICAL EXPERIMENT
Stephen K. Cox and Bruce A. Albrecht Feb. 1976 110 p ref (Grant NSF OCD-74-21678)
(PB-257375/6; AS-Paper-244; NOAA-76060205) Avail: NTIS HC A06/MF A01 CSCL 04A

A description of the basic radiation data gathering systems used on three U.S. Aircraft during the GARP Atlantic Tropical Experiment is presented. In addition to an explanation of the hardware used, the data reduction procedures applied to the raw data are given in detail. Significant problems encountered in the data are also discussed. GRA

N77-14667# Office of Naval Research, London (England).
CONFERENCE ON MAGNETOSPHERIC AND PARTICLE PHYSICS
Martin S. Harris 2 Apr. 1976 9 p Conf. held at Sheffield (England), 31 Mar. - 2 Apr. 1976
(AD-A027624; ONRL-C-16-76) Avail: NTIS HC A02/MF A01 CSCL 04/1

A conference on Magnetospheric and Particle Physics was held during 31 March - 2 April 1976 at the University of Sheffield sponsored by the Institute of Physics and the Royal Astronomical Society. The meeting covered the topics of reconnection and convection, structure and stability, particles and their origins, waves, fields, and pulsations in the magnetosphere. Author (GRA)

N77-14668# General Electric Co., Santa Barbara, Calif.
REACTION RATE DATA, NUMBER 55
Mar. 1976 17 p
(Contract DNA001-75-C-0023; DNA Proj. NWED-QAXDC008)
(AD-A027201) Avail: NTIS HC A02/MF A01 CSCL 04/1

Summaries of research on atmospheric chemistry and physics are presented. Reaction kinetics, atomic and molecular physical processes, and thermochemistry related to the upper atmosphere are included. GRA

N77-14669# General Electric Co., Santa Barbara, Calif.
REACTION RATE DATA, NUMBER 56
Apr. 1976 19 p refs
(Contract DNA001-75-C-0023; DNA Proj. NWED-QAXDC008)
(AD-A027269) Avail: NTIS HC A02/MF A01 CSCL 04/1

The report consists of 3 parts. Part 1, DNA-sponsored research, has the following major headings: Reaction rates critical to propagation; Theoretical investigations of ionizing mechanism in the upper atmosphere; Atomic and molecular physics of IR emissions; Part 2 contains abstracts of relevant reports. Part 3 discusses non-DNA-sponsored research. GRA

N77-14670# Naval Research Lab., Washington, D.C. Airborne Radar Branch.
MICROWAVE RADIOMETRIC DETECTION OF ATMOSPHERIC INTERNAL WAVES Interim Report
Lee U. Martin and Charles I. Beard May 1976 32 p refs
(NRL Proj. B07-37; RR0210141)
(AD-A026523; NRL-MR-3283) Avail: NTIS HC A03/MF A01 CSCL 04/1

Microwave radiometers have, for the first time, detected internal waves in the atmospheric boundary layer and localized their altitude. Varying the intersection height of a narrow (3 deg) antenna beam with that of a wide (22 deg) vertically pointing antenna beam allowed determination of the wave altitudes. The ground-based radiometers were located at San Diego, where, in an experiment in May- June 1975, the Naval Electronics Laboratory Center (NELC) provided 'atmospheric-truth' for comparison to the radiometer data obtained by the Naval Research Laboratory. NELC provided FM-CW radar, acoustic sounder, lidar, microbarograph, radiosonde, and surface meteorological data. Preliminary results showed cases of correspondence between the signals of the passive radiometers and the active FM-CW radar and acoustic sounder systems. Examples included internal wave trains up to an hour in length. Author (GRA)

N77-14671# Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.
EVALUATION OF THE EXPERIMENTAL DESIGN AND THE ESTIMATION OF PARAMETERS BY DEEP CRUSTAL ELECTROMAGNETIC SOUNDING SYSTEMS Final Report
William R. Sill, Bruce D. Smith, and Stanley H. Ward 1976 44 p refs
(Contract N00014-67-A-0325-0013; NR Proj. 081-295)
(AD-A026516) Avail: NTIS HC A03/MF A01 CSCL 08/14

The objective of this report is to quantitatively examine the problem determining parameters of a resistive layer in the earth's crust by electrical sounding methods. The advantages and disadvantages of a quantitive assessment of the resolution of model parameters is briefly examined. Particular electrical sounding methods considered here are; (1) magnetotelluric and audio magnetotelluric methods (MT-AMT); (2) direct current (dc) Schlumberger (VES) method; and (3) dc dipole-dipole sounding methods with a finite source and receiver. These methods constitute, in principle, the majority of electrical methods which have been used to determine electrical parameters of the earth's crust. An important class of electrical sounding methods, the artificial or controlled source electromagnetic induction methods, is not considered. First described are general aspects of qualitative and quantitative methods to estimate the resolving power of a given set of crustal sounding measurements. Resolving power is the capability of the measurements to determine the bounds of a set of earth model parameters. For the crustal sounding problem, the model parameters are the resistivities and the layer thicknesses of a horizontally stratified earth. Finally, the resolving power of a particular set of sounding measurements is described. GRA

N77-14672# National Oceanic and Atmospheric Administration, Boulder, Colo. Air Resources Lab.
MEASUREMENTS TO EVALUATE THE BENCHMARK PROPERTIES OF ATMOSPHERIC AEROSIS
Bernard G. Mendonca Jan. 1976 34 p refs
(PB-256091/0; NOAA-TR-ERL-355; ARL-3; NOAA-76051301)
Avail: NTIS HC A03/MF A01 CSCL 04A

An experimental program was designed to monitor and analyze atmospheric aerosols. Observations from two Fort Collins sites indicate that the urban signature in aerosol concentrations, size distributions, hygroscopicity, and organic content is evident to 5.0 km from the center of the city. The surface sampling showed the mass median diameters of the aerosol measured to be in the 2.5 x 0.00025 cm range. The submicron aerosols, however, were the more hygroscopic, the more active cloud condensation nuclei, and were slightly more organic in content. Evaluation of the instruments and techniques used describes the shortcomings of the measurement system, as well as the benefits of a composite measurement array for benchmark monitoring of atmospheric aerosols. Author (GRA)

N77-14673# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
SELDADS: AN OPERATIONAL REAL-TIME SOLAR-TERRESTRIAL ENVIRONMENT MONITORING SYSTEM
D. J. Williams Mar. 1976 79 p refs
(PB-256131/4; NOAA-TR-ERL-357; SEL-37;
NOAA-76051303) Avail: NTIS HC A05/MF A01 CSCL 04A

The real time solar terrestrial environment monitoring system is described. Information provided includes sources of data, computer systems employed, kinds of data now available and soon to be available, methods of accessing data, and names and addresses of key personnel to contact for access. A description of each type of data available is given which includes satellites or observatories reporting, parameters reported, frequency of report, medium of report, retention period for on line availability, list of display formats, and sample displays. GRA

N77-14674# Air Force Geophysics Lab., Hanscom AFB, Mass.
CALCULATED AND MEASURED HF/VHF ABSORPTION FOR THE 2-5 NOVEMBER 1969 SOLAR PROTON EVENT
William Swider and Irving L. Chidsey, Jr. 9 Mar. 1976 20 p refs
(DNA Proj. NWED-QAXHD208; DNA Proj.

NWET-L25AAXHX631)
(AD-A027637; AFGL-TR-76-0053; AFGL-ERP-554) Avail: NTIS HC A02/MF A01 CSCL 03/2

Electromagnetic wave absorption was measured at several frequencies as a function of altitude for six rocket flights during the 2 to 5 November 1969 Solar Proton Event (SPE). Meaningful data were obtained at 36 MHz, 18 Mhz, and 9 MHz for four of these flights. These data and 30 MHz riometer data are shown to be in excellent accord with the calculated absorption. The agreement provides further support for the accuracy claimed for the electron concentrations that were measured simultaneously by means of dispersive phase techniques. It is stressed that uncertainties in the pressure are probably the largest error source. The electromagnetic wave absorption apparently was unaffected by the SPE-disturbed D-region except for the enhanced electron concentration. Author (GRA)

N77-14675# Air Force Geophysics Lab., Hanscom AFB, Mass.
AN ANALYTICAL MODEL OF THE MAIN F-LAYER TROUGH Air Force Surveys in Geophysics
C. P. Pike 4 May 1976 22 p refs
(AF Proj. 7663)
(AD-A026031; AFGL-TR-76-0098; AFGL-AFSG-343) Avail: NTIS HC A02/MF A01 CSCL 04/1

Tabulated values of F-layer critical frequency (foF2), that were scaled from ISIS-2 topside ionograms, have been used to study the main F-layer trough. These foF2 values were selected because they contained good examples of the trough near midnight, in mid-winter, and under quiet and disturbed geomagnetic conditions. The study shows that the steep electron density gradient that characterizes the poleward wall of the trough is typically equal to 43,000 electrons cu cm per deg. The wall extends over about 3 deg of latitude. At the latitude of the base of the poleward trough wall, the electron density is typically 48,000 electrons cu cm (foF2 < 2.0 MHz). The trough is 4 deg wide in latitude at 2 MHz; that is, foF2 values remain at or below MHz for about 4 deg of latitude equatorward from the poleward trough wall. Likewise, the trough is 11 deg wide at 2.5 MHz and 19 deg wide at 3.0 MHz. An equation is given in the test that can be used to characterize foF2 values in the trough in near real-time based on readily observable geophysical parameters. Author (GRA)

N77-14676# Scripps Institution of Oceanography, San Diego, Calif. Visibility Lab.
AIRBORNE MEASUREMENTS OF OPTICAL ATMOSPHERIC PROPERTIES IN WESTERN WASHINGTON Interim Report
Seibert Q. Duntley, Richard W. Johnson, and Jacqueline I. Gordon Aug. 1975 259 p refs
(Contract F19628-73-C-0013; AF Proj. 7621)
(AD-A026036; SIO-Ref-75-24; Scientific-5; AFCRL-TR-75-0414) Avail: NTIS HC A12/MF A01 CSCL 04/1

This report presents daytime atmospheric optical data collected chiefly with airborne instruments during a field expedition to western Washington in the summer of 1974. Results from seven flights are presented. The data include the natural irradiance upon horizontal plane surfaces, scalar irradiances, total volume scattering coefficients, atmospheric beam transmittances, path radiances, directional path reflectances, and directional terrain reflectances. Data for daytime conditions ranging from clear skies to completely overcast were derived for downward-looking paths of sight inclined at six zenith angles (95, 100, 105, 150, and 180 degrees) from altitudes of 1200 meters above ground level and lower. All data were measured with a broad band sensitivity representing pseudo-photopic spectral response with a mean wavelength of 557 nanometers. Author (GRA)

N77-14677# Photometrics, Inc., Lexington, Mass.
QUANTITATIVE OPTICAL DATA ANALYSIS ON CHEMICAL RELEASES Final Report, 1 Jan. 1975 - 31 Mar. 1976
Christian A. Trowbridge, Ronald H. Johnson, and Irving L. Kofsky 30 Apr. 1976 55 p refs
(Contract F19628-75-C-0025; AF Proj. 7635)
(AD-A026214; PHM-102-76; AFGL-TR-76-0093) Avail: NTIS HC A04/MF A01 CSCL 04/1

A continuing program whose objective is the study of atmospheric winds and temperatures, chemical reaction processes, composition, and diffusive and turbulent transport, in the upper atmosphere and stratosphere is described. These parameters are studied through analysis and interpretation of photographic and other optically derived data on chemical and smoke tracers released from rockets and high flying aircraft. Images of the tracers were reduced by microdensitometry, and films and cameras radiometrically calibrated to determine absolute radiances and inventories of sunlight-scattering particles. Stratospheric winds were derived from photographic measurement of the transport of smoke trails released from rockets, and a means of increasing sensitivity of photographic emulsions to extremely faint glows was investigated. Author (GRA)

N77-14678# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
WORKSHOP ON ATMOSPHERIC TRANSMISSION MODELING Final Report
Vincent J. Corcoran Dec. 1975 210 p refs
(Contract DAHC15-73-C-0200)
(AD-A026354; P-1152; IDA/HQ-75-17974) Avail: NTIS HC A10/MF A01 CSCL 04/1

This is a report on a workshop on atmospheric transmission modeling. The workshop was divided into a morning session in which papers relating to the topic were presented and an afternoon workshop that was divided into a physics and engineering session and a session on computer modeling. The purpose of the workshop was to bring together those people who have contributed to computer modeling of atmospheric transmission, those who use the programs, and those who have evaluated the programs so that a consensus could be obtained concerning present models, the problem areas, and what must be done to evolve a model or models that would be acceptable in the future. Author (GRA)

N77-14679# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
INFRARED COOLING OF THE ATMOSPHERE BY THE 9.6 MICRON BAND OF OZONE M.S. Thesis
Walter Joseph Slade, Jr. Feb. 1975 79 p refs
(AD-A026272; AFIT-CI-76-43) Avail: NTIS HC A05/MF A01 CSCL 04/1

Monthly values of the radiative cooling of the atmosphere from 0-70 kilometers by the 9.6 micrometer band of ozone are calculated using a random band model to represent frequency integration combined with a 3-parameter inhomogeneous path approximation. Effects of line shape variability above 30 km are handled by a correction factor calculated from the Voigt integral. Calculations were made on a global basis using data from a three-dimensional 26 level general circulation model above 30 kilometers and observational data below 30 kilometers. Results indicate maximum cooling at 50 km with a maximum value of 5.4 C/day at 60 degrees N in June and at 60 degrees S in December. Slight radiative heating occurs above the tropopause with a maximum value of 0.2 C/day. Values approach zero near the ground and near 70 km. Ozone is concluded to be a major contributor to the radiative budget of the middle and upper stratosphere. GRA

N77-14680# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A STUDY OF HETEROGENEOUS ICE NUCLEATION MECHANISMS USING A NEW ICE THERMAL DIFFUSION CHAMBER Ph.D. Thesis
Robert C. Schaller Dec. 1975 34 p refs
(AD-A026271; AFIT-CI-76-38) Avail: NTIS HC A03/MF A01 CSCL 04/1

This new method for precision control of thermodynamic environmental variables, supersaturation in particular, that surround freely suspended ice nuclei particles, and subsequent theoretical analysis of data, have resulted in some discoveries and clarified many long standing confusions concerning heterogeneous ice nucleation. The present study has been carried out with three main purposes: first, to build and operate a new ice thermal diffusion chamber which is capable of precisely controlling a range of supersaturations under steady-state conditions at a given temperature for an ice nucleant smoke (no substrate effect); second, to experimentally identify the mechanisms of ice nucleation under the defined environmental conditions of the

experiment, and the aerosol particles; and, third, to develop a theory which could describe the obtained quantitative data. GRA

N77-14681# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

IONOSPHERIC EFFECTS RESULTING FROM PRECIPITATING ELECTRONS AT MID AND HIGH LATITUDES Final Report, 1 Nov. 1974 - 30 Jan. 1976

J. B. Cladis, W. E. Francis, G. T. Davidson, and M. Walt 30 Jan. 1976 67 p refs

(Contract DNA001-75-C-0139;
DNA Proj. NWET-L25AAXYX966)
(AD-A027297; LMSC/D500513; DNA-3884F) Avail: NTIS HC A04/MF A01 CSCL 20/14

The distributions of electrons resulting from pitch-angle diffusion due to both wave-particle interactions at high altitudes and binary collisions in the atmosphere have been determined. The results seem to be in agreement with available data, however wave fields which may be too high are required to fit the data. Some of the computational routines and cross sections used in the low-energy (1 eV to 500 eV) portion of the AURORA code have been improved. Processes occurring in the disturbed ionosphere other than collision and magnetic mirroring are inferred by comparing measurements of pitch-angle and energy distributions of electrons in the auroral zones with distributions computed with the AURORA code. Author (GRA)

N77-14682# Air Force Geophysics Lab., Hanscom AFB, Mass.

MODEL OF EQUATORIAL SCINTILLATIONS FROM IN SITU MEASUREMENTS Environmental Research Papers

Sunanda Basu, Santimay Basu, and B. K. Khan 13 Apr. 1976 31 p refs

(AF Proj. 4643)
(AD-A027041; AFGL-TR-76-0080; AFGL-ERP-555) Avail: NTIS HC A03/MF A01 CSCL 20/14

In situ measurements of F-region irregularity amplitude and ambient electron density made by the retarding potential analyzer (RPA) on OGO-6 near perigee altitude of 400 km have been utilized to derive the variation of electron density deviation over the equatorial region. Based on these measured electron density deviations and other assumed model parameters, including a three-dimensional power-law form of irregularity spectrum of index 4, a model of equatorial scintillations is developed in the framework of diffraction theory. The percentage occurrence contours of estimated equatorial scintillations greater than or equal to 4.5 dB at 140 MHz during 1900 to 2300 LMT for the period November to December 1969 and 1970 have been derived. The model is found to depict a pronounced longitude variation with the scintillation belt width and percentage occurrence being maximum over the African sector. The latitude extent of the spatial scintillation belt narrows over the American sector without much decrease in the scintillation occurrence whereas over the Indian and Far Eastern sectors both the extent and the occurrence are found to decrease. The percentage occurrence of scintillations estimated from this model is found to be consistent with VHF scintillation measurements at Ghana, Huancayo, and Calcutta. In addition, the model was found to be in qualitative agreement with GHz observations at various longitudes made by the COMSAT group. The effect of varying model parameters on scintillation estimates at VHF, UHF and GHz are discussed. Implications of the observed longitudinal variation of scintillations on current theories of equatorial irregularity formation are indicated.
Author (GRA)

N77-14683# Ballistic Research Labs., Aberdeen Proving Ground, Md.

PHOTODISSOCIATION OF O2(+) (H2O) Final Report

J. A. Vanderhoff and R. A. Beyer Jun. 1976 20 p refs

(DA Proj. 1T1-61102-B-53A; DNA Proj. NWED-QAXHD010)
(AD-A027628; BRL-MR-2642) Avail: NTIS HC A02/MF A01 CSCL 04/1

The photodissociation cross section of the weakly bound positive ion cluster O2(-)(H2O) has been measured at 15 discrete energies between 1.833 and 2.727 eV. Measurements indicate the cross section increases smoothly from 0.6 to 6 x 10 to the -18th power sq cm over this energy range. These cross section values are the largest reported for a positive ion cluster of atmospheric importance. GRA

N77-14684# Air Force Geophysics Lab., Hanscom AFB, Mass.

LOWER-THERMOSPHERE NEUTRAL DENSITY PROFILES DERIVED FROM SATELLITE ACCELEROMETER DATA

F. A. Marcos and J. L. Mendillo 4 Mar. 1976 18 p refs

(AF Proj. 6690)
(AD-A027040; AFGL-TR-76-0045; AFGL-ERP-553) Avail: NTIS HC A02/MF A01 CSCL 04/1

The Cannon Ball II and SPADES satellites carried triaxial accelerometer systems for accurate measurement of neutral atmospheric density. Cannon Ball II was launched 6 August 1971 into a polar elliptic orbit in which the initial perigee was at the extremely low altitude of 132 km. SPADES was launched 11 July 1968 into a polar elliptic orbit in which the initial perigee was at 155 km. The data, analyzed to deduce an average density profile for each satellite for summer conditions in the northern hemisphere, are for the altitude region 135 to 250 km, where measurements have heretofore been extremely sparse. Comparisons were made with recent models and experimental data. These results are intended to be supplemented by those of lower-thermosphere studies now being carried out on accelerometer data from the Atmosphere Explorer satellites and a low-altitude Air Force satellite. Comprehensive analyses of accelerometer data low-altitude satellites will allow accurate modeling of the lower thermosphere. These models are required for improving calculation of the trajectories of Air Force systems vehicles and other spacecraft GRA

N77-14685# Stanford Research Inst., Menlo Park, Calif.

ICECAP '74: CHATANIKA RADAR RESULTS Topical Report, Mar. 1974 - Dec. 1975

Paul D. Perreault and Murray J. Baron Oct. 1975 123 p refs

(Contract DNA001-74-C-0167;
DNA Proj. NWET-L25AAXHX631; SRI Proj. 3118)
(AD-A026703; DNA-3871T) Avail: NTIS HC A06/MF A01 CSCL 04/1

ICECAP is an auroral measurements program to acquire geophysical data required for the formulation and testing of models and predictive computer codes. The models and codes describe atmospheric ionization, excitation, and optical emissions in the (Aurorally) disturbed ionosphere. These codes are needed to assess and evaluate the operation of critical DoD radar and optical systems in nuclear disturbed environments. Auroral disturbances studied in ICECAP are similar to nuclear disturbances in that both are characterized by dramatic visual displays, enhanced infrared airglows, and enhanced plasma densities resulting from the interaction of energetic electronics with the atmospheric constituents. The general objectives of ICECAP are: to provide measurements of chemical emission processes occurring in the disturbed atmosphere; to uncover unsuspected chemical or interactive processes leading to important infrared radiations; to provide experimental data against which models and computer codes can be compared and evaluated; and to provide data that can be used to update and improve theoretical models and predictive computer codes. GRA

N77-14686# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

THERMAL AND DYNAMIC CONDITIONS OF ICE IN STREAMS, AS APPLIED TO NORWAY

Olaf Devik Mar. 1976 125 p refs Transl. into ENGLISH from Geofys. Publikasjoner, Norway (Oslo), v. 9, no. 1, 1931
(AD-A027019; CRREL-TL-513) Avail: NTIS HC A06/MF A01 CSCL 08/12

The paper gives the results of studies on the physical problems of ice formation and applies the analysis to practical examples, primarily to Norwegian conditions. GRA

N77-14687# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

CREEP THEORY FOR A FLOATING ICE SHEET

Donald E. Nevel Jun. 1976 112 p refs

(AD-A026122; CRREL-SR-76-4) Avail: NTIS HC A06/MF A01 CSCL 08/12

The problem investigated in this thesis is the prediction of the deflection and stresses in a floating ice sheet under loads which act over a long period of time. This problem is currently important for oil exploration offshore in the Arctic. A review of analytical methods for predicting the bearing capacity of an ice

sheet is given. The problem is formulated by assuming the ice is isotropic with a constant Poisson's ratio. The shear modulus is assumed to obey a linear viscoelastic model. The specific model selected is a series of one Maxwell model and two Voigt models. One of the Voigt models has a negative spring constant which produces tertiary creep. The ice model exhibits a primary, secondary, and tertiary creep response, similar to that observed in uniaxial creep tests of ice. The material properties in the viscoelastic model may be a function of the vertical position in the ice sheet, but all these material properties must be proportional to the same function of position. Using the thin-plate theory for the floating ice sheet, the solution is obtained for the deflection and stresses in the ice sheet for primary, secondary, and tertiary creep regions. It is then shown that for a load that is not distributed over a large area, the time-dependent part of the deflection and stresses is relatively independent of the load's distribution. For the elastic case, the stress significantly depends upon the load's distribution. Results are given for the deflection and stresses as a function of time and distance from the load. The maximum deflection and stresses occur at the center of the load. At this point the deflection increases with time, while the stresses decrease; i.e., the stresses relax. Author (GRA)

N77-14688# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

PREPARATION OF THE ICE CRYSTALS, EXCERPT FROM THESIS

G. Dantl May 1976 9 p Transl. into ENGLISH from "Preparation der Eiskristalle in Elastiche Modulun und Mechanische Dampfung in Eis" Stuttgart, Technische Hochschule, 1967 p 22-25
(AD-A026071; CRREL-TL-522) Avail: NTIS HC A02/MF A01 CSCL 08/12

This is an excerpt from a West German thesis on elastic moduli and mechanical damping in single crystals of ice. GRA

N77-14689# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

CONTRIBUTION TO MEASURING SUCTION AND INTERSTITIAL PRESSURE IN UNSATURATED SOILS

J. Verbrugge Jul. 1976 202 p refs Transl. into ENGLISH from the mono. "Contribution a la Mesure de la Succion et de la Pression Interstitielle dans les Sols Non Satures" Brussels Free University, Jacques Verdeyen Lab., 1974 p 1-212
(AD-A027020; CRREL-TL-529) Avail: NTIS HC A10/MF A01 CSCL 08/13

This study analyzes the geotechnical possibilities afforded by the Peltier-effect psychrometer for measuring the humidity potential of soil, which is to say the suction. After a description of the principal existing apparatus, some original equations are developed which make it possible to tie suction, s, to the signal supplied by the psychrometer, on the basis of its geometric features. With the help of these equations, analysis is performed on the effects of establishing equilibrium, temperature, pressure, and the presence of a soil sample as well as calibration. These considerations then make it possible to compare the psychrometer with apparatus in current use -- suction plate, tensiometer, pressure chamber and vacuum dryer -- and to show its advantages. Finally, after describing the experimental device, calibration results are given which show the validity of the equations set up; also given are suction measurements taken on a silt, which show the validity of the psychrometric method. GRA

N77-14690# Lamont-Doherty Geological Observatory, Palisades, N.Y.

THEORY AND CALCULATIONS FOR THE DISPLACEMENTS AND STRESSES AT AN EARTHQUAKE SOURCE Final Report, 1 Oct. 1973 - 31 Mar. 1976

Paul G. Richards 1 Jun. 1976 55 p refs
(Contract F44620-74-C-0029; ARPA Order 1827)
(AD-A027713; AFOSR-76-0833TR) Avail: NTIS HC A04/MF A01 CSCL 08/11

Contents: First strong motion records from a Central or Eastern United States earthquake; Source properties of a Blue Mountain Lake earthquake; Comparison of strong ground motion from several dislocation models; The dynamic field of a growing plane elliptical shear crack; Motions near a shallow rupturing fault: evaluation of effects due to the free surface; and List of publications. GRA

N77-14691# Computer Corp. of America, Cambridge, Mass.

DATACOMPUTER SUPPORT OF SEISMIC DATA ACTIVITY Quarterly Technical Report, 1 Feb. - 30 Apr. 1976

30 Apr. 1976 15 p
(Contract MDA903-74-C-0227; ARPA Order 2613)
(AD-A026380; QTR-1) Avail: NTIS HC A02/MF A01 CSCL 08/11

The purpose of this project is to provide seismic data storage and retrieval services. These services are to be provided via the Datacomputer being developed and maintained by Computer Corporation of America (CCA) for ARPA under a separate Contract No. MDA903-74-C-0225. The seismic data is to be received over the Arpanet and made available to a variety of computers on the Arpanet. GRA

N77-14692# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Weapon Effects Lab.

CORRELATION OF IMPACT AND EXPLOSIVELY CREATED GROUND SHOCK PHENOMENA Final Report

Max B. Ford Jun. 1976 77 p refs
(DA Proj. 4A0-61101-A-91D)
(AD-A027059; WES-MP-N-76-10) Avail: NTIS HC A05/MF A01 CSCL 19/4

A technique for prediction of ground motions in the transition and far-out regions where outrunning surface waves are transporting most of the energy is described. A statistically significant number of surface ground motion velocity measurements were produced by detonating high-explosive (HE) spheres of differing yields and depths of burst. Similar measurements were obtained from energy sources realized by impacting free-falling weights. The tests in this study were conducted on a nearly homogeneous sandstone formation in October 1973 at a site near Grand Junction, Colorado, along with Project CENSE (Coupling Efficiency of Near Surface Explosions). The CENSE series consisted of detonations of eight 1000-lb nitromethane spheres and the SHE (Small High Explosive) series consisted of 20 detonations of C-4 spheres ranging in weights from 1 to 27 lb. Fourteen SMIT (Spherical Mass Impact Technique) tests were conducted by releasing a 6800-lb demolition ball from heights ranging from 20 to 40 ft. GRA

N77-14126# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).

REVIEW OF IMPORTANT PROBLEMS IN PHYSICS OF THE AURORAL ZONE

G. Pfotzer *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 59-91 refs
(For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14132# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany).

FIRST OBSERVATION OF ELECTROSTATIC ACCELERATION OF BARIUM IONS INTO THE MAGNETOSPHERE

G. Haerendel, E. Rieger, A. Valenzuela, H. Foeppl, H. C. Stenbaek-Nielsen (Univ. of Alaska, College), and E. M. Wescott (Univ. of Alaska, College) *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 203-211 refs (For primary document see N77-14120 05-12)
(Grant BMFT-WRK-RV-14-B47/73-SE-20)
Avail: NTIS HC A24/MF A01

N77-14133# Norwegian Defence Research Establishment, Kjeller.

POLAR 5, NORWEGIAN/US ELECTRON ACCELERATOR SOUNDING ROCKET

T. A. Jacobsen, B. N. Maehlum, and J. Troeim *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 213-220 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14134# European Space Research and Technology Center, Noordwijk (Netherlands).

PLASMA DIAGNOSTIC AND WAVE DETECTION WITH ELECTRON EMITTERS

R. Grard *In* ESA European Programmes on Sounding-Rocket

and Balloon Res. in the Auroral Zone 1976 p 221-226 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14135# Mullard Space Science Lab., Dorking (England).
SUPERTHERMAL ELECTRON FLUXES DURING VARIOUS PHASES OF AURORAL SUBSTORMS
J. J. Sojka, W. J. Raitt, and A. D. Johnstone *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 227-240 refs Sponsored by Sci. Res. Council (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14136# Bergen Univ. (Norway).
ROCKET MEASUREMENTS OF X-RAYS AND ENERGETIC ELECTRONS THROUGH AN AURORAL ARC
K. Aarsnes, J. Stadsnes, and F. Soeraas *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 241-249 refs Sponsored by Roy. Norweg. Council for Sci. and Ind. Res. (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14137# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany).
CO-ORDINATED MEASUREMENTS WITH EISCAT, SOUNDING ROCKETS AND BALLOONS AIMED AT PLASMA-PHYSICAL STUDIES
G. Haerendel *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 253-262 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14146# Observatoire de Paris-Meudon (France).
THE SCHEME OF SELF COORDINATION TENTATIVELY SET UP BY THE IMS STEERING COMMITTEE
P. Simon *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 339-342 (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14148# Liege Univ. (Belgium).
SOME RECENT RESULTS ON THE AURORAL ATMOSPHERE DURING THE BREAKUP PHASE
R. Duysinx a d M. Henrist *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 351-358 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14149# Southampton Univ. (England).
DIRECTION FINDING STUDIES OF WHISTLER MODE SIGNALS: SOME CAMPAIGNS FUNDED FOR THE IMS
M. J. Rycroft *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 359-369 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14150# Bergen Univ. (Norway).
MEASUREMENTS OF AURORAL-ZONE PHENOMENA BY A VERSATILE BALLOON-BORNE PAYLOAD
J. Bjordal, K. Broenstad, T. E. Moe, J. Stadsnes, S. Ullaland, A. Egeland (Oslo Univ.), N. Karlsen (Oslo Univ.), and E. Thrane (Norweg. Defence Res. Estab., Kjeller) *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 371-385 refs Original contains color illustrations (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14151# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
A PROPOSED METHOD FOR THE DIRECT MEASUREMENT OF ENHANCED RESISTIVITY
L. R. O. Storey and M. Malingre *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 387-409 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14152# European Space Research and Technology Center, Noordwijk (Netherlands).
PROPOSED HIGH ALTITUDE RESONANCE CONE AND PARAMETRIC DECAY EXPERIMENT
R. W. Boswell, G. Ventura (Florence Univ.), and G. Martelli (Sussex Univ.) *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 411-419 refs (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

N77-14153# Sheffield Univ. (England).
CO-ORDINATED ROCKET AND GROUND-BASED STUDIES OF THE STRUCTURE AND DYNAMICS OF THE LOWER THERMOSPHERE
W. Gibbons, T. R. Kaiser, S. P. Kingsley, H. G. Muller, and L. J. C. Woolliscroft *In* ESA European Programmes on Sounding-Rocket and Balloon Res. in the Auroral Zone 1976 p 421-432 refs Sponsored by Sci. Res. Council (For primary document see N77-14120 05-12)
Avail: NTIS HC A24/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N77-14693# World Meteorological Organization, Geneva (Switzerland).
BASIC SYNOPTIC NETWORKS OF OBSERVING STATIONS
1976 536 p In FRENCH and ENGLISH
(WMO-217) HC A23/MF A01; WMO, Geneva

Background information on the decisions governing the establishment and implementation of the basic synoptic network in the six WMO regions and Antarctica is given. Detailed information, on a country by country basis within the regions, on the present state of the network - giving such details as stations and observational programs, types of observation, and state of implementation - is also given. Network maps are included. For individual titles, see N77-14694 through N77-14700.

N77-14694# World Meteorological Organization, Geneva (Switzerland).
REGION 1: AFRICA
In its Basic Synoptic Networks of Observing Stations 1976 110 p In FRENCH and ENGLISH (For primary document see N77-14693 05-47)
Copyright. Avail: NTIS HC A23/MF A01; WMO, Geneva

Background information on the decisions governing the establishment and implementation of the basic synoptic network in Africa is given. The stations and observational programs comprising the basic synoptic network are presented on a country by country basis together with the state of implementation and plans for elimination of deficiencies. Network maps are included. ESA

N77-14695# World Meteorological Organization, Geneva (Switzerland).
REGION 2: ASIA
In its Basic Synoptic Networks of Observing Stations 1976 87 p In FRENCH and ENGLISH (For primary document see N77-14693 05-47)
Copyright. Avail: NTIS HC A23/MF A01; WMO, Geneva

Background information on the decisions governing the establishment and implementation of the basic synoptic network in Asia is given. The stations and observational programs comprising the basic synoptic network are presented on a country by country basis together with the state of implementation and plans for elimination of deficiencies. Network maps are included. ESA

N77-14696# World Meteorological Organization, Geneva (Switzerland).
REGION 3: SOUTH AMERICA
In its Basic Synoptic Networks of Observing Stations 1976

48 p In FRENCH and ENGLISH (For primary document see N77-14693 05-47)
Copyright. Avail: NTIS HC A23/MF A01; WMO, Geneva

Background information on the decisions governing the establishment and implementation of the basic synoptic network in South America is given. The stations and observational programs comprising the basic synoptic network are presented on a country by country basis together with the state of implementation and plans for elimination of deficiencies. Network maps are included. ESA

N77-14697# World Meteorological Organization, Geneva (Switzerland).
REGION 4: NORTH AND CENTRAL AMERICA
In its Basic Synoptic Networks of Observing Stations 1976 77 p In FRENCH and ENGLISH (For primary document see N77-14693 05-47)
Copyright. Avail: NTIS HC A23/MF A01; WMO, Geneva

Background information on the decisions governing the establishment and implementation of the basic synoptic network in North and Central America is given. The stations and observational programs comprising the basic synoptic network are presented on a country by country basis together with the state of implementation and plans for elimination of deficiencies. Network maps are included. ESA

N77-14698# World Meteorological Organization, Geneva (Switzerland).
REGION 5: SOUTH-WEST PACIFIC
In its Basic Synoptic Networks of Observing Stations 1976 72 p In FRENCH and ENGLISH (For primary document see N77-14693 05-47)
Copyright. Avail: NTIS HC A23/MF A01; WMO, Geneva

Background information on the decisions governing the establishment and implementation of the basic synoptic network in the South-West Pacific is given. The stations and observational programs comprising the basic synoptic network are presented on a country by country basis together with the state of implementation and plans for elimination of deficiencies. Network maps are included. ESA

N77-14699# World Meteorological Organization, Geneva (Switzerland).
REGION 6: EUROPE
In its Basic Synoptic Networks of Observing Stations 1976 91 p In FRENCH and ENGLISH (For primary document see N77-14693 05-47)
Copyright. Avail: NTIS HC A23/MF A01; WMO, Geneva

Background information on the decisions governing the establishment and implementation of the basic synoptic network in Europe is given. The stations and observational programs comprising the basic synoptic network are presented on a country by country basis together with the state of implementation and plans for elimination of deficiencies. Network maps are included. ESA

N77-14700 World Meteorological Organization, Geneva (Switzerland).
REGION 7: ANTARCTIC
In its Basic Synoptic Networks of Observing Stations 1976 35 p In FRENCH and ENGLISH (For primary document see N77-14693 05-47)
Copyright. Avail: NTIS HC A23/MF A01; WMO, Geneva

Background information on the decisions governing the establishment and implementation of the basic synoptic network in Antarctica is given. The stations and observational programs comprising the basic network are presented on a country by country basis together with the state of implementation and plans for elimination of deficiencies. Network maps are included. ESA

N77-14701# Illinois State Water Survey, Urbana.
HYDROMETEOROLOGY OF HEAVY RAINSTORMS IN CHICAGO AND NORTHEASTERN ILLINOIS. PHASE 1: HISTORICAL STUDIES
Floyd A. Huff and John L. Vogel 1976 69 p refs
(Grant NSF ENV-76-01447)
(PB-257062/0; ISWS/RI-82/76; W76-11875) Avail: NTIS HC A04/MF A01 CSCL 04B

Results of an investigation of heavy rainstorms in the Chicago urban area and the surrounding six counties are presented, based on available historical data of rainfall and associated weather conditions. The counties are Cook, Du Page, Kane, Will, Lake, and McHenry. Frequency distributions of point rainfall are presented for rain periods from 5 minutes to 72 hours and recurrence intervals of 6 months to 50 years. Also presented are the relationship between point and areal mean rainfall frequencies, time and space distribution characteristics of heavy rains, orientation and movement of storms, the frequency distribution of storm centers, synoptic weather conditions associated with severe rainstorms, and the diurnal, monthly, and seasonal distribution of flood-producing storms. GRA

N77-14702# National Oceanic and Atmospheric Administration, Boulder, Colo. Weather Modification Program Office.
A PRELIMINARY ESTIMATE OF A TROPICAL CYCLONE TRACK CHANGE CAUSED BY ARTIFICIAL ENHANCEMENT OF CONVECTIVE HEAT RELEASE
Robert W. Jones Apr. 1976 29 p refs Sponsored by the Dept. of Commerce
(PB-257254/3; NOAA-TM-ERL-WMPO-27; NOAA-76060404)
Avail: NTIS HC A03/MF A01 CSCL 04B

The response of a three-level, three-dimensional model of a tropical cyclone to artificial enhancement of the convective heating rate, such as may occur by man's efforts to modify a hurricane, was examined. Results with symmetric and asymmetric distributions of enhanced convection show that the principal short-term (up to 21 hours after the enhancement begins) effect of the enhancement upon the track of the vortex was to include a trochoidal oscillation about the mean path of the control experiment. GRA

N77-14703# National Oceanic and Atmospheric Administration, Washington, D.C. Center for Experiment Design and Data Analysis.
THERMAL TIME CONSTANTS OF US RADIOSONDE SENSORS USED IN GATE
Scott L. Williams and Donald T. Acheson May 1976 21 p refs Sponsored by the Dept. of Commerce
(PB-257367/3; NOAA-TM-EDS-CEDDA-7; NOAA-76061410)
Avail: NTIS HC A02/MF A01 CSCL 04B

Equations for computing thermal time constants of U.S. radiosonde sensors used in the GARP Atlantic Tropical Experiment were developed. GRA

N77-14704# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.
CLIMATOLOGY OF STAGNATING ANTICYCLONES EAST OF THE ROCKY MOUNTAINS, 1936 - 1975
Julius Korshover Mar. 1976 30 p refs
(PB-257368/1; NOAA-TM-ERL-ARL-55; NOAA-76061506)
Avail: NTIS HC A03/MF A01 CSCL 04B

Stagnating anticyclones are often associated with incidents of heavy air pollution in urban areas. A 40-year climatology is presented to delineate occurrences of stagnating anticyclones in the eastern United States. Occurrences of stagnation are determined on the basis of pressure gradient values considered with other meteorological factors. Affected areas are depicted on maps by use of a system of grid points. Data showing cases of stagnation (i.e., episodes) are shown on both an annual and seasonal basis. These data indicate that stagnation is most likely in autumn. The total number of stagnation days for the 40 year period is also shown. GRA

N77-14705# Air Force Geophysics Lab., Hanscom AFB, Mass.
ATLAS OF PROBABILITIES OF SURFACE TEMPERATURE EXTREMES. PART 1: NORTHERN HEMISPHERE
Paul Tattelman 16 Apr. 1976 35 p refs
(AF Proj. 8624)
(AD-A027640; AFGL-TR-76-0084-Pt-1; AFGL-ERP-557-Pt-1)
Avail: NTIS HC A03/MF A01 CSCL 04/2

A method for calculating warm (cold) temperature extremes during the warmest (coldest) month of the year was developed. Regression analyses were performed for warm (cold) temperature versus an index calculated from a station's monthly mean temperature and mean daily range. Correlation for these regression

lines ranges from 0.974 to 0.995. Warm and cold indices, calculated for approximately 2000 Northern Hemisphere stations, were plotted and analyzed. The resulting Northern Hemisphere maps of the 1-, 5-, and 10-percent warm temperatures, and the 1-, 5-, 10-, and 20-percent cold temperatures for the warmest (coldest) month are presented. Author (GRA)

N77-14706# Naval Environmental Prediction Research Facility, Monterey, Calif.
CLEARING FOG BY SEEDING WITH CHARGED WATER DROPS: A NUMERICAL STUDY
Paul Tag May 1976 53 p refs
(WF52551715)
(AD-A027410; NEPRF-TP-6-76) Avail: NTIS HC A04/MF A01 CSCL 04/2

A numerical study of the use of highly charged water drops to clear warm fog has been conducted. The polarization of neutral fog droplets and their capture by the charged drops is the mechanism studied. A multi-leveled microphysical model is used to investigate the degree of visibility improvement resulting from variations in seeding drop size and charge, the type of fog being seeded, and the concentration of seeding material. An evaluation of this technique is made by comparing model results to comparable numerical experiments of hygroscopic seeding, a technique that has been field tested on several occasions.
Author (GRA)

N77-14707# Texas A&M Univ., College Station. Dept. of Physics.
RADIANCE DISTRIBUTION OVER A RUFFLED SEA: CONTRIBUTIONS FROM GLITTER, SKY, AND OCEAN
Gilbert N. Plass, George W. Kattawar, and John A. Guinn, Jr. 20 May 1976 21 p
(Contract N00014-75-C-0537; NR Proj. 083-036)
(AD-A025711; TR-9) Avail: NTIS HC A02/MF A01 CSCL 20/6

The upward radiance just above the ocean surface and at the top of the atmosphere is calculated for a realistic model including an ocean surface with waves. The separate contributions of the sun glitter, the reflected sky radiance, and the upwelling photons from the ocean are calculated. The Monte Carlo method takes account of both Rayleigh scattering by the molecules and Mie scattering by the aerosols as well as molecular and aerosol absorption in the atmosphere. Similarly, in the ocean, both Rayleigh scattering by the water molecules and Mie scattering by the hydrosols as well as absorption by the water molecules and hydrosols are considered. Separate single-scattering functions are used for the aerosols and hydrosols calculated from the Mie theory. It is possible to answer various questions about the interaction of light with the ocean from the quantitative results presented here. GRA

N77-14708*# National Meteorological Center, Washington, D.C.
A TEST OF THE IMPACT OF NOAA-2 VTPR SOUNDINGS ON OPERATIONAL ANALYSES AND FORECASTS
William D. Bonner, Paul L. Lemar, Robert J. VanHaaren, Armand J. Desmarais, and Hugh M. ONeil Feb. 1976 49 p refs
(NASA Order S-70252-AG)
(NASA-CR-149295; PB-256075/3; NOAA-76032502; NOAA-TM-NWS-NMC-57) Avail: NTIS HC A03/MF A01 CSCL 04B

The impact of vertical temperature profile radiometer (VTPR) data from the NOAA-2 satellite is examined by comparing numerical analyses and forecasts made with and without these data. For 30 days in March and April 1973, parallel analyses were produced using the same analysis and forecast codes but with VTPR soundings excluded from the data base for the parallel mode. Forecasts to 48-hr were made from parallel-mode analyses on 9 of these days. Comparisons between these forecasts and the corresponding operational forecasts show at best a very slight improvement in forecast skill from use of VTPR soundings. GRA

N77-14709# National Meteorological Center, Washington, D.C.
OPERATIONAL-TYPE ANALYSES DERIVED WITHOUT RADIOSONDE DATA FROM NIMBUS 5 AND NOAA 2 TEMPERATURE SOUNDINGS
William D. Bonner, Robert VanHaaren, and Christopher M. Hayden Mar. 1976 23 p refs
(PB-256099/3; NOAA-TM-NWS-NMC-58; NOAA-76051703) Avail: NTIS HC A02/MF A01 CSCL 04B

Test analyses were produced with the National Meteorological Center (NMC) global analysis/forecast system using only surface reports and satellite temperature soundings. Data were assimilated over a period of 4 days using a 6-hr analysis/forecast cycle. The final test analysis describes the major features shown on the corresponding NMC analysis but underestimates the amplitudes of disturbances and the intensity of thickness gradients. GRA

N77-14710# National Weather Service, Garden City, N.Y.
IMPROVING SHORT-RANGE PRECIPITATION GUIDANCE DURING THE SUMMER MONTHS
David B. Gilhousen Mar. 1976 26 p refs
(PB-256427/6; NOAA-TM-NWS-ER-61; NOAA-76040904) Avail: NTIS HC A03/MF A01 CSCL 04B

An objective technique was developed for modifying 12- to 24-hour precipitation guidance forecasts from the NMC primitive equation model. Manually digitized radar and the Limited Fine Mesh Model 12- to 24-hour precipitation are utilized. Developmental data were obtained from two stations in the eastern United States for the summer season. Constructed radar variables were entered into a stepwise multiple regression program with the PE precipitation probabilities and the LFM precipitation forecast. The resulting equation yielded a 15-35 percent improvement in the Brier score over the PE. In comparison, subjective improvement by Eastern Region forecast offices of the National Weather Service over the PE guidance amounts to 10-15 percent. GRA

N77-14711# Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
THE DETERMINATION OF REGIONAL EVAPOTRANSPIRATION BY MEANS OF STANDARD METEOROLOGICAL DATA
Wilfried H. Brutsaert Aug. 1976 55 p refs
(Contract DI-14-34-0001-6101)
(PB-256213/0; W76-11110; OWRT-B-052-NY(1)) Avail: NTIS HC A04/MF A01 CSCL 04B

A recently proposed procedure to calculate actual regional evapotranspiration, using only regularly recorded upper air meteorological data, based on the parameterization of the turbulent atmospheric boundary layer, was further investigated in an attempt to develop guidelines for its application in the solution of hydrological problems. In a first phase a comparison was continued between predicted evapotranspiration and measured watershed evapotranspiration in eastern Nebraska. It was found that contrary to the general assumption, the similarity function for water vapor in the atmospheric boundary layer is different from that for sensible heat. GRA

N77-14712# Naval Postgraduate School, Monterey, Calif.
USNS HAYES MARINE FOG CRUISE: PRELIMINARY EVALUATION OF NAVAL POSTGRADUATE SCHOOL DATA
Preliminary Report, Jul. - Dec. 1975
Gordon E. Schacher 2 Apr. 1976 70 p
(AD-A027573; NPS-61SQ76041) Avail: NTIS HC A04/MF A01 CSCL 04/2

This report summarizes the participation of the Naval Postgraduate School aboard the USNS Hayes on a marine fog cruise in the North Atlantic. The equipment which was installed aboard the ship and the types of measurements which were made are described. Tables of the mean data taken are presented as well as some preliminary evaluation of the data.
Author (GRA)

N77-14713# Naval Postgraduate School, Monterey, Calif.
SPECTRUM ANALYSIS OF EASTERLY WAVES IN THE TROPICAL PACIFIC DURING TWO CONTRASTING PERIODS OF SEA-SURFACE TEMPERATURE ANOMALIES
Preliminary Report, Jul. 1975 - Jul 1976
Chih-Pei Chang and C. R. Miller, III Jul. 1976 50 p refs
Sponsored in part by NOAA
(AD-A027255; NPS-63CJ76071) Avail: NTIS HC A03/MF A01 CSCL 04/2

The structure and properties of the tropical easterly waves have been found to vary considerably between different regimes and time periods. This study investigates the possible roles played

by the temporal and spatial sea-surface temperature (SST) variations on the waves. Time series of tropical western pacific radiosonde data during two contrasting eight-month periods of SST anomalies, May - December 1972, which has abnormally high SST in the central and eastern Pacific, and May - December 1973, which has below normal SST in the same region, are analyzed. In both periods, the waves have the same periodicity of 4-5 days and a lower tropospheric zonal wavelength on the order of 3,300 km, but their vertical phase and amplitude distributions as well as the thermal structures are different. The results are discussed in terms of two possible influences the SST variations may have on the waves: (1) direct effect, the warmer SST represents stronger thermal control through cumulus heating; and (2) indirect effect, the variation of SST changes the large-scale mean wind circulation which, in turn, has a strong impact on the wave vertical structure and the relative importance of energy sources other than cumulus heating. Finally, a schematic model of these influences is proposed which may be applied to both the temporal and the spatial variations of SST.

Author (GRA)

N77-14714# RAND Corp., Santa Monica, Calif.
STATISTICAL CONSIDERATIONS IN THE EVALUATION OF CLIMATIC EXPERIMENTS WITH GENERAL CIRCULATION MODELS
John A. Laurmann and W. Lawrence Gates Dec. 1975 48 p refs
(AD-A026657; P-5503) Avail: NTIS HC A03/MF A01 CSCL 04/2

Numerical calculations made with general circulation models contain short-term fluctuations that need to be taken into account when considering the significance of long-term climatic means. In particular, when such models are used in the study of climatic change resulting from altered forcing, quantitative evaluation of the effects of the fluctuations, as measured by the variance of model generated climatic estimates, is required. This report develops a rationale for planning the extent of climate simulation trials needed to establish the significance of any proposed climatic change experiment. The topic is treated from an elementary statistical viewpoint, and the report is in part written to serve as an introduction to statistical questions that are important for climate modeling. Conclusions concerning the planning of climatic change experiments include a quantitative prescription for determining the extent of model calculations required to establish the presence of a climatic change between two numerical experiments at any chosen confidence level. GRA

N77-14715# Air Force Geophysics Lab., Hanscom AFB, Mass.
OBSERVATIONS OF THE NATURAL DISSIPATION OF APPALACHIAN VALLEY FOG Environmental Research Papers
Vernon G. Plank and Alfred A. Spatola 3 May 1976 21 p refs
(AF Proj. 7605)
(AD-A026510; AFGL-TR-76-0100; AFGL-ERP-558) Avail: NTIS HC A02/MF A01 CSCL 04/2

The manner of the natural dissipation of Appalachian Valley fog is described for a narrow, steep-walled valley located near White Sulphur Springs, W. Va., that was observed on 29 Aug 69, and for a wide, flat-bottomed valley located near Lewisburg, W. Va., that was observed 29 Sep 69. With the fog of the narrow valley, an apparent valley breeze developed at approximately 0915 EDT that transported the peripheral fog laterally upward into the intersecting canyons and ravines. The fog then began to exhibit a convective upper structure along the valley walls that gradually extended completely across the valley. Initial clearing occurred between the convective elements and progressed by means of the continued size diminution and disappearance of the elements. In the terminal dissipation phase of the fog, the sky cover conditions changed rapidly from broken to clear within a few minutes time (from 1020 to 1033 EDT). Auxiliary data indicate that this is the usual, common mode of fog dissipation of two possible modes. The fog of the wide valley dissipated convectively in similar fashion except that obvious valley-breeze effects were lacking and that the terminal dissipation phase of the fog, proceeding from generally broken sky cover conditions to clear conditions, required a period of an hour or so. Much patterning of the clouds occurred during this phase which correlated with the topographical patterning of the places of lowest elevation within the valley. GRA

N77-14716# Naval Postgraduate School, Monterey, Calif.
FOG ON THE CENTRAL CALIFORNIA COAST FOR 1973, ANALYSIS OF TRENDS M.S. Thesis
John W. Beardsley Mar. 1976 121 p refs
(AD-A026325; NPS-58LR76031) Avail: NTIS HC A06/MF A01 CSCL 04/2

Surface visibility data for selected stations on the central California coast in 1973 are analyzed. Radiosonde data from Oakland for the same period are used to derive meteorological indices. The year is divided into fog-related seasons, summer and winter, based on fog occurrence on the coast; and the seasonal and daily fluctuations of the indices are examined. A fog development model for the summer is formulated and compared to actual fog cases. In the winter, with far fewer coastal fog observations, the frequent occurrence of frontal passages prevents a standard development model from being formulated and compared. Four Oakland soundings are compared with four radiosondes taken at NPS Monterey, and the Oakland Soundings are found to closely approximate coastal conditions on these days. Author (GRA)

N77-14717# Naval Postgraduate School, Monterey, Calif.
APPLICATION OF MODEL OUTPUT STATISTICS TO TROPICAL CYCLONE FORECASTING IN THE WESTERN PACIFIC M.S. Thesis
Robert Ernest Little Mar. 1976 35 p refs
(AD-A026245) Avail: NTIS HC A03/MF A01 CSCL 04/2

Analog tropical cyclone forecasting techniques inherently include some mean interaction of the cyclone with its synoptic environment. This investigation seeks to relate current synoptic features to storm displacement. The objective forecasting technique, Model Output Statistics (MOS), along with the so called ridged regression biased estimator are used to predict recurvature or non-recurvature of tropical cyclones. Corrections to an analog forecast position are also predicted. It is shown that a larger data set is required before any conclusive results in predicting recurvature or non-recurvature can be made. However, the most fruitful area for application of MOS does appear to be in the recurvature/non-recurvature problem and not in the area of corrections to an analog forecast. The ridged regression estimator generally proves superior to the ordinary least squares estimator as a method of determining predictive equations. Author (GRA)

N77-14718# Naval Research Lab., Washington, D.C.
POLAR AUTOMATIC WEATHER STATION Final Report
Walter A. VonWald, Jr. 13 May 1976 59 p
(NRL Proj. A03-11; WF52551714)
(AD-A026233; NRL-7983) Avail: NTIS HC A04/MF A01 CSCL 04/2

The Polar Automatic Weather Station (PAWS) was developed to meet a need for detailed weather data from polar regions. It telemeters windspeed and direction (1-min averages), barometric pressure, and air temperature via a high-frequency radio link when interrogated by a central station. The accuracy of the telemetered data is as follows: windspeed, + or - 1 n.mi/h; wind direction, + or - 5 deg; barometric pressure, + or - 1 mbar; air temperature, + or - 1 F (0.55 C). The PAWS has a radioisotope power generator that can supply power for at least 5 years of unattended operation. A detailed description of the equipment, its operation, and the results of field trials is presented. Recommendations are presented for eliminating the problems encountered during field trials. GRA

N77-14719# Hawaii Univ., Honolulu. Dept. of Meteorology.
CROSS-EQUATORIAL INTERACTIONS IN THE DEVELOPMENT OF A WINTER TYPHOON: NANCY 1970
Charles P. Guard May 1976 50 p refs
(Contract N00228-75-C-2045; WF52551713)
(AD-A027532; UHMET-74-6; NEPRF-TP-4-75) Avail: NTIS HC A03/MF A01 CSCL 04/2

Although winter typhoons can be as intense and destructive as seasonable ones, little research has been devoted to these off-season tropical cyclones. This synoptic and dynamic study is of such a storm. Typhoon Nancy (19-27 Feb 70). It examines

anomalies in the February 1970 circulation patterns over the Western Pacific and uses them to explain the formation and development of Nancy. Special emphasis is placed on the impact of cross-equatorial interactions during the storm's genesis. GRA

N77-14720# Avco-Everett Research Lab., Everett, Mass.
TURBULENCE CHARACTERIZATION AND CONTROL Final Technical Report, 1 Feb. - 15 Oct. 1975
M. G. Miller, P. L. Zieske, and G. Dryden Jun. 1976 58 p refs
(Contract F30602-75-C-0012; ARPA Order 2646; AF Proj. 2646)
(AD-A027155; RADC-TR-76-189) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report covers activities relative to the characterization of the turbulent environment at the ARPA Maui Observation Station. Three areas are discussed. The first deals with the deployment of various instrumental systems to be used in the experimental program. These include micrometeorological sensors, a computer data processing system, and acoustic Sounder, the NOAA Star Sensor and the Hughes Seeing Monitor which are all presently operational. GRA

N77-14721# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Science Lab.
SATFAL: THE APPLICATION OF METEOROLOGICAL SATELLITE DATA TO NUCLEAR FALLOUT PREDICTION
Louis D. Duncan 1976 14 p refs
(AD-A025994) Avail: NTIS HC A02/MF A01 CSCL 18/8

The SATFAL system employs the advanced technology provided by meteorological satellites to provide an efficient means for satisfying the Army's requirements for upper altitude wind data. The procedure and theory for determination of the wind profile from radiance measurements obtained by vertical temperature sounders on polar orbiting meteorological satellites are presented and discussed. An analysis of 32 comparisons of SATFAL and conventional radiosonde wind observations shows that there is very little (indeed acceptable) difference between fallout predictions computed from wind obtained by the two procedures. With the current steady improvement of the state of the art in satellite radiometric measurements and technology, steadily increasing SARFAL wind accuracy is expected. Because of its basic simplicity and automated concepts, the SATFAL system is ideally suited for tactical battlefield applications. Since this system will provide all the wind data required by the Army above 15 km, it will obviate the need for high altitude balloonsondes and should, thereby, allow for reduction in meteorological equipment and personnel required for such observations. GRA

N77-14722# Control Data Corp., Minneapolis, Minn. Research Div.
A PILOT ANALYSIS OF THE CURVATURE OF EXTRATROPICAL STORMS Final Report, Jun. 1975 - Jan. 1976
D. G. Dartt 2 Oct. 1976 50 p refs
(Contract N00228-75-C-2363)
(AD-A027412; NEPRF-TR-2-76(CDC)) Avail: NTIS HC A03/MF A01 CSCL 04/2

Curvature properties of satellite cloud patterns are examined for the purpose of defining indirect measures of intensity and motion of extratropical storms. The distribution of centers of curvature among concentric cloud bands near the storm center is used to objectively locate the center of the storm and to derive a parameter related to storm intensity. This intensity parameter is proportional to the radius and number of concentric cloud bands and appears useful for describing time variations of strength of the storm's circulation. A model hyperbolic spiral is also used to characterize the primary spiral cloud band of extratropical disturbances. The calculated intensity of the spiral appears useful for measuring the development of the storm as depicted by the 500 mb relative vorticity. The asymptote of the spiral may also be a reasonably good predictor of the direction of the following 12-hourly storm trajectory. Perhaps, the most promising application of the techniques is for remotely monitoring by satellite the strength of vortices over ocean regions. Previous efforts under the contract have been concerned with the application of the above techniques to tropical storms. The details of this study have been reported separately in an earlier report, Objective Tropical Storm Parameters from Satellite Cloud Patterns. An abstract of the first report is included as preface to this report. Author (GRA)

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N77-14723 Washington Univ., Seattle.
A GENERAL MODEL OF THE OCEAN MIXED LAYER USING A TWO-COMPONENT TURBULENT KINETIC ENERGY BUDGET WITH MEAN TURBULENT FIELD CLOSURE Ph.D. Thesis
Roland William Garwood, Jr. 1976 140 p
Avail: Univ. Microfilms Order No. 76-25406

A nonstationary, one-dimensional bulk model of a mixed layer bounded by a free surface above and a stable non-turbulent region below is derived. The vertical and horizontal components of turbulent kinetic energy are determined implicitly, along with layer depth, mean momentum and mean buoyancy. Both layer growth by entrainment and layer retreat in the event of a collapse of the vertical motions due to buoyant damping and dissipation are predicted. Dissert. Abstr.

N77-14724*# Ocean Data Systems, Inc., Rockville, Md.
DEVELOPMENT OF SPECIFICATIONS FOR SURFACE AND SUBSURFACE OCEANIC ENVIRONMENTAL DATA Final Technical Report
Paul M. Wolff Jun. 1976 113 p
(Contract NASw-2558)
(NASA-CR-149211) Avail: NTIS HC A06/MF A01 CSCL 08J

The existing need for synoptic subsurface observations was demonstrated giving special attention to the requirements of meteorology. The current state of synoptic oceanographic observations was assessed; a preliminary design for the Basic Observational Network needed to fulfill the minimum needs of synoptic meteorology and oceanography was presented. There is an existing critical need for such a network in the support of atmospheric modeling and operational meteorological prediction, and through utilization of the regional water mass concept an adequate observational system can be designed which is realistic in terms of cost and effort. Author

N77-14725# Royal Netherlands Meteorological Inst., De Bilt.
EXPERIENCES AND RESULTS OF THE SHIP ROUTEING OF THE ROYAL NETHERLANDS METEOROLOGICAL INSTITUTE (KNMI)
C. G. Korevaar 1976 67 p refs
(KNMI-WR-76-9) Avail: NTIS HC A04/MF A01

Since 1960, an ever increasing number of ships has been routed by the Royal Netherlands Meteorological Institute. The result on several routes across the North Atlantic Ocean during the period August 1969 to August 1974 is described. Distinction is made between westbound and eastbound voyages, winter and summer season, different types of ships, and different speed classes. Some results are also given on a monthly basis. Next to the saving of time, it is shown that there are other benefits of weather routing, such as less risk of damage to ship and cargo, more comfort for passengers and crew, a better ability to meet schedule, and a better estimation of the time of arrival. Author (ESA)

N77-14726# National Oceanic and Atmospheric Administration, Rockville, Md.
PASSAGE OF ANTICYCLONIC GULF STREAM EDDIES THROUGH DEEPWATER DUMPSITE 106 DURING 1974 AND 1975
James J. Bisagni Apr. 1976 46 p refs
(PB-257523/1; NOAA-Dumpsite-Evaluation-76-1; NOAA-76060301) Avail: NTIS HC A03/MF A01 CSCL 08C

The formational theory and characteristics of anticyclonic gulf stream eddies in the western north Atlantic Ocean are summarized. Their occurrence, trajectories, and structure, were observed using XBT data and infrared satellite imagery to relate their passage

through Deepwater Dumpsite 106 off the New York Bight and over the continental slope and rise. The frequency with which these eddies pass through the dumpsite, their residence times within the dumpsite, and the total time they occupy the dumpsite each year were computed to determine their potential effects on ocean dumping. GRA

N77-14727# Scripps Institution of Oceanography, La Jolla, Calif.
MEAN TS CURVES IN THE PACIFIC AND THEIR APPLICATION TO DYNAMIC HEIGHT COMPUTATIONS
Richard T. Wert and William J. Emery 22 Apr. 1976 127 p refs
(Contract N00014-75-C-0152; Grant NSF OCE-74-24583)
(AD-A027216; SIO-Ref-76-6) Avail: NTIS HC A07/MF A01 CSCL 08/10

Smoothed mean curves of temperature versus salinity are computed from all available hydrographic data for 10 deg squares in the Pacific between 20 deg S and 40 deg N. Together these curves provide information on the distribution of water masses. Graphs of the individual curves are presented which include the scatter of TS pairs and the standard deviation in salinity along each curve. Salinity at a temperature interval of 1 C is also given in tabular form for each curve. Author (GRA)

N77-14728# Alaska Univ., College.
THE ARCTIC COASTAL ENVIRONMENT OF ALASKA. VOLUME 1: THE NEARSHORE MARINE ENVIRONMENT IN PRUDHOE BAY, ALASKA
H. M. Feder, D. G. Shaw, and A. S. Naidu Mar. 1976 167 p refs
(Grant NOAA-04-5-158-35)
(PB-257353/3; IMS-R76-1-Vol-1; Sea Grant-76-3-Vol-1; NOAA-76060210) Avail: NTIS HC A08/MF A01 CSCL 08A

The results of three investigations: biological, geological, and hydrocarbon chemistry are reported. The three studies are closely interrelated. The investigations described were at and near the site of a causeway construction project on the west side of Prudhoe Bay, and had as their objectives: (1) Biology - document the distribution and density of benthic animals in order to develop a benthic biological base; (2) Geology - document the grain size distributions, geochemical properties, sources of and movements of the sediment; and correlate this information with the habitat preferences of the benthic animals; (3) Chemistry - survey the kinds and amounts of hydrocarbons present in the biota and sediments. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N77-14729*# Kanner (Leo) Associates, Redwood City, Calif.
THE EFFECT OF PROLONGED HYPOKINESIS ON THE HEART MUSCLE OF RATS
I. Prokhazka, I. V. Khavkina, and Z. I. Barbashova Washington NASA 20 Dec. 1976 11 p refs Transl. into ENGLISH from Fiziologicheskiy Zhurnal SSSR (Kiev), v. 59, No. 8, 1973 p 1237-1241
(Contract NASw-2790)
(NASA-TT-F-17332) Avail: NTIS HC A02/MF A01 CSCL 06C

In test animals (rats), 30-40 days of hypokinesis resulted in a sharp decrease in body weight and heart weight (especially the right ventricle). Weakening of the contractility of the myocardium and its resistance to hypoxic stress were found. In this case, a decrease in the anaerobic metabolism rate was found in the ventricles: of glycolysis and glycogenolysis in the right and glycogenolysis in the left. The glycogen content of the heart muscle of the rat was unchanged after 30-40 days of hypokinesis. Author

N77-14730*# Boeing Co., Houston, Tex.
SEVERAL METHODS FOR CONCENTRATING BACTERIA IN FLUID SAMPLES Quarterly Report, Apr. - Jun. 1976
Richard R. Thomas Aug. 1976 52 p refs
(Contract NAS5-22545)
(NASA-CR-144830) Avail: NTIS HC A04/MF A01 CSCL 06C

The sensitivities of the firefly luciferase - ATP flow system and luminol flow system were established as 300,000 E. coli per milliliter and 10,000 E. coli per milliliter respectively. To achieve the detection limit of 1,000 bacteria per milliliter previously established, a method of concentrating microorganisms using a sartorius membranfilter system is investigated. Catalase in 50% ethanol is found to be a stable luminol standard and can be used up to 24 hours with only a 10% loss of activity. The luminol reagent is also stable over a 24 hour period. A method of preparing relatively inexpensive luciferase from desicated firefly tails is developed. Author

N77-14731*# Kanner (Leo) Associates, Redwood City, Calif.
THE STERILIZING ACTION OF A GASEOUS FORMOL: USE OF A CHAMBER EQUIPPED WITH A VENTILATION SYSTEM
M. Dupeu Washington NASA Jan. 1977 24 p refs Transl. into ENGLISH of Ouest Med. (France), v. 29, no 17, 1976 p 1149-1158
(Contract NASw-2790)
(NASA-TT-F-17513) Avail: NTIS HC A02/MF A01 CSCL 06B

Formol was used in a chamber with forced ventilation, varying the gaseous formol concentration and the exposure time. This method has made it possible to determine the bacteriostatic and bactericidal activity of this agent against microorganisms frequently encountered in a hospital environment, examined under practical conditions. Author

N77-14732*# GARD, Inc., Niles, Ill.
STUDY OF REMOVAL OF AMMONIA FROM URINE VAPOR BY DUAL CATALYST Final Report, May - Oct. 1976
P. Budininkas Nov. 1976 40 p refs
(Contract NAS2-9219)
(NASA-CR-151930) Avail: NTIS HC A03/MF A01 CSCL 06B

The feasibility of ammonia removal from urine vapor by a low temperature dual-catalyst system was investigated. The process is based on the initial catalytic oxidation of ammonia present in urine vapor to nitrogen and nitrous oxide, followed by a catalytic decomposition of the nitrous oxide formed into its elements. The most active catalysts for the oxidation of ammonia and for the decomposition of N2O, identified in screening tests, were then combined into dual catalyst systems and tested to establish their overall efficiencies for the removal of ammonia from artificial gas mixtures. Dual catalyst systems capable of ammonia removal from the artificial gas mixtures were then tested with the actual urine vapor produced by boiling untreated urine. A suitable dual catalyst bed arrangement was found that achieved the removal of ammonia and organic carbon, and recovered water of good quality from urine vapor. Author

N77-14733# Mississippi State Univ., Mississippi State. Water Resources Research Inst.
THE EFFECTS OF VARIATIONS IN TURBIDITY ON CYCLES OF PLANKTONIC AND BENTHIC ORGANISMS IN FLOOD CONTROL RESERVOIRS
Y. J. McGaha, John W. Burris, and Charles M. Cooper Jul. 1976 47 p refs Prepared in cooperation with Miss. Univ., University Sponsored by Interior Dept.
(PB-256555/4; W76-11172; OWRT-A-090-MISS(1)) Avail: NTIS HC A03/MF A01 CSCL 13B

The effects of turbidity on plankton and macrobenthos cycles in four northern Mississippi flood control reservoirs were studied. Turbidity measurements in part per million SiO2 were analyzed with other concomitant physiochemical data to ascertain the effects of suspended materials on planktonic and benthic cycles in the impoundments. A quantitative plankton analysis was made, and 27 of the most abundant genera were entered in a computerized stepwise regression analysis against 20 predictor variables consisting of the physiochemical data. The main emphasis of the bethos was in Grenada Reservoir, Mississippi. GRA

N77-14078# Simon Stevin Instituut voor Wetenschappelijk Onderzoek, Brugge (Belgium).
SEPARATION METHODS IN SPACE BIOLOGY
H. Peeters *In* ESA Mater. Sci. in Space Sep. 1976

p 129-133 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14081# Max-Planck-Institut fuer Biochemie, Martinsried bei Muenchen (West Germany).
IMMUNOLOGICAL ASPECTS IN SPACE EXPERIMENTS AND THE POSSIBILITIES OF CELL SEPARATION BY CONTINUOUS-FLOW ELECTROPHORESIS
D. Leihener *In* ESA Mater. Sci. in Space Sep. 1976 p 149-154 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14082# Oregon Univ., Portland. Health Sciences Center.
DETAILED RESULTS OF ASTP EXPERIMENT MA-011
G. V. F. Seaman, R. E. Allen (NASA, Marshall Space Flight Center), G. H. Barlow (Abbott Labs., Chicago), and M. Bier (Veteran's Admin. Hosp., Tucson, Ariz.) *In* ESA Mater. Sci. in Space Sep. 1976 p 155-166 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01 CSCL 06B

N77-14083# British Aircraft Corp. (Operating) Ltd., Bristol (England). Electronic and Space Systems Group.
PRELIMINARY STUDY OF A GENERAL-PURPOSE FLOATING-ZONE ELECTROPHORESIS FACILITY FOR SPACELAB
G. Lewis, P. R. Foster (Scot. Natl. Blood Transfusion Serv.), and B. White (Scot. Natl. Blood Transfusion Serv.) *In* ESA Mater. Sci. in Space Sep. 1976 p 167-174 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14084*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
CONTINUOUS-FLOW ELECTROPHORETIC SEPARATOR FOR BIOLOGICALS
L. R. McCreight, R. N. Griffin, and R. J. Locker *In* ESA Mater. Sci. in Space Sep. 1976 p 175-179 Sponsored in part by NASA (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01 CSCL 06B

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N77-14734 Polish Academy of Sciences, Warsaw.
ULTRASOUDCARDIOGRAPHIC NORMS OF THE LEFT VENTRICLE, THE MITRAL VALVE, AND THE INTERCHAMBER SEPTUM AMONG CHILDREN OF SPECIAL AGE GROUPS [NORMY ULTRASONOKARDIOGRAFICZNE LEWET KOMORY ZASTAWKI DWUDZIELNEJ I PPZEGRODY MIEDZYKOMOROWEJ U DZIECI W POSZCZEGOLNYCH GRUPACH WIEKU]
Krystyna Borkowska 11 Mar. 1976 68 p refs In POLISH
Avail: Issuing Activity

On the basis of studies of 436 healthy children aged 1 to 17 years, ultrasoudcardiographic norms of the left ventricle, the mitral valve, and the interchamber septum were derived, and a marked dynamic dependency of calculated values of individual parameters on the physiological development of the heart structures was discovered. For the majority of the studied parameters, abrupt growth of body surface in certain periods of the child's life (5-6, 13-14) and physiological deceleration of heart activity were observed to exert a strong influence on the results of the ultrasoudcardiographic tests. The derived norms taking into account yearly age intervals can have practical application in evaluating echo-cardiograms of children with various heart ailments. Author

N77-14735* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ACTUATOR DEVICE FOR ARTIFICIAL LEG Patent
John L. Burch, inventor (to NASA) Issued 7 Dec. 1976 7 p Filed 12 Sep. 1975 Supersedes N75-32767 (13 - 23, p 2963)
(NASA-Case-MFS-23225-1; US-Patent-3,995,324; US-Patent-Appl-SN-612965; US-Patent-Class-3-1.2; US-Patent-Class-3-14) Avail: US Patent Office CSCL 06B

An actuator device is described for moving an artificial leg of a person having a prosthesis replacing an entire leg and hip joint. The device includes a first articulated hip joint assembly carried by the natural leg and a second articulated hip joint assembly carried by the prosthesis whereby energy from the movement of the natural leg is transferred by a compressible fluid from the first hip joint assembly to the second hip joint assembly for moving the artificial leg.
Official Gazette of the U.S. Patent Office

N77-14736* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIQUID COOLED BRASSIERE AND METHOD OF DIAGNOSING MALIGNANT TUMORS THEREWITH Patent
William Elkins (Acurex Corp.), Bill Alvin Williams, and Ernest Glenn Tickner, inventors (to NASA) (Acurex Corp.) Issued 7 Dec. 1976 8 p Filed 27 Jan. 1976 Supersedes N76-18782 (14 - 09, p 1168)
(NASA-Case-ARC-11007-1; US-Patent-3,995,621; US-Patent-Appl-SN-652948; US-Patent-Class-128-2H; US-Patent-Class-128-379; US-Patent-Class-128-400; US-Patent-Class-128-402) Avail: US Patent Office CSCL 06B

A device for enhancing the detection of malignant tissue in the breasts of a woman was described. A brassiere-like garment which is fitted with a pair of liquid-perfused cooling panels which completely and compliantly cover the breasts and upper torso was studied. The garment is connected by plastic tubing to a liquid cooling system comprising a fluid pump, a solenoid control valve for controlling the flow of fluid to either the cooling unit or the heating unit, a fluid reservoir, a temperature sensor in the reservoir, and a restrictor valve to control the pressure in the garment inlet cooling line.
Official Gazette of the U.S. Patent Office

N77-14737* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD AND SYSTEM FOR IN VIVO MEASUREMENT OF BONE TISSUE USING A TWO LEVEL ENERGY SOURCE Patent
John R. Cameron (Wisconsin U., Madison) and Philip F. Judy, inventors (to NASA) (Wisconsin U., Madison) Issued 7 Dec. 1976 8 p Filed 11 Mar. 1975 Supersedes N75-21948 (13 - 13, p 1552) Sponsored by NASA
(NASA-Case-MSC-14276-1; US-Patent-3,996,471; US-Patent-Appl-SN-557430; US-Patent-Class-250-444; US-Patent-Class-250-498; US-Patent-Class-250-363R) Avail: US Patent Office CSCL 06B

Methods and apparatus are provided for radiologically determining the bone mineral content of living human bone tissue independently of the concurrent presence of adipose and other soft tissues. A target section of the body of the subject is irradiated with a beam of penetrative radiations of preselected energy to determine the attenuation of such beam with respect to the intensity of each of two radiations of different predetermined energy levels. The resulting measurements are then employed to determine bone mineral content.
Official Gazette of the U.S. Patent Office

N77-14738* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PERCUTANEOUS CONNECTOR DEVICE Patent
Walter E. Parsons, inventor (to NASA) Issued 7 Dec. 1976 6 p Filed 16 Sep. 1975 Supersedes N76-19816 (14 - 10, p 1303)
(NASA-Case-KSC-10849-1; US-Patent-3,995,644; US-Patent-Appl-SN-613734; US-Patent-Class-128-418; US-Patent-Class-3-1.1; US-Patent-Class-339-252R) Avail: US Patent Office CSCL 06B

A device is reported for facilitating the passage of electrical signals from an external source through the skin of a patient to internal portions of the body such as muscles and nerves. The connector device includes a bio-compatible shell having an enlarged disk shaped portion for being implanted below the skin of the patient. The shell has a first and second electrically

conductive post carried therein upon which a plug can be readily connected and disconnected. A modified form of the invention utilizes a unipolar connector that is adapted to be plugged into a shell implanted below the skin of a patient. Both of the connector devices are designed to be separated when a predetermined force is applied. This prevents excessive force from being applied to the implanted bio-compatible shell.

Official Gazette of the U.S. Patent Office

N77-14739# Michigan Univ., Ann Arbor. Dept. of Chemical Engineering.

EVALUATION OF THE COMPATIBILITY OF MATERIALS IN CONTACT WITH BLOOD Annual Report, Jun. 1975 - Jun. 1976

J. S. Schultz, A. A. Cizrkowski, J. D. Goddard, S. M. Lindenauer, and J. S. Penner Jul. 1976 85 p refs

(Contract N01-HB-4-2962)

(PB-257219/6; NIH-N01-HB-4-2962-2) Avail: NTIS HC A05/MF A01 CSCL 06L

An ex-vivo test procedure using dogs was developed for testing the thrombogenicity of biomaterials in contact with blood. A couette-type test chamber capable of producing independent mass transfer and shear stress variations on a rotating specimen in the form of a 3/16 inch x 4 inch shaft was used for measuring the formation rate and composition of thrombus formed under well defined hemodynamic conditions. The design of these experiments consisted of a parallel arrangement of test chambers such that two materials were tested simultaneously with one material being a reference material. GRA

N77-14740# Nuclear Regulatory Commission, Washington, D.C. Office of Nuclear Reactor Regulation.

OCCUPATIONAL RADIATION EXPOSURE AT LIGHT WATER COOLED POWER REACTORS, 1969-1975

Thomas D. Murphy, Nadia J. Dayem, J. Stewart Bland, and Walter J. Pasciak Jun. 1976 25 p

(PB-257054/7; NUREG-0109) Avail: NTIS HC A02/MF A01 CSCL 06J

An updated compilation of occupational radiation exposures at commercial light water cooled power reactors for the years 1969 through 1975 is presented. The information is derived from reports submitted to the United States Nuclear Regulatory Commission in accordance with requirements of individual plant technical specifications. The MAN-REM/UNIT for all LWR's in 1975 is greater than the 1974 value. The cumulative average since 1969 continues to increase. No significant trend was indicated over the period of 1969-1975 in the mean value of MAN-REM/MEGAWATT-YEAR. GRA

N77-14741# Army Research Inst. of Environmental Medicine, Natick, Mass.

CURRENT APPROACHES TO RESOLVING THE PHYSIOLOGICAL HEAT STRESS PROBLEMS IMPOSED BY CHEMICAL PROTECTIVE CLOTHING SYSTEMS

Ralph F. Goldman and John R. Breckenridge 1976 7 p refs

(AD-A026003) Avail: NTIS HC A02/MF A01 CSCL 06/17

Possible improvements over totally impermeable chemical protective clothing for use in toxic environments have been characterized along three approaches: partially permeable garments impregnated with detoxifying or adsorbing substances; impermeable systems supplied with filtered ambient air ventilation; impermeable systems with wettable covers. Although the latter approach has much to recommend it, logistics of required water is a distinct problem. The only other alternatives, short of air conditioned clothing ensembles, is by intelligent informed command control of work-rest ratios, or actual replacement of units as they approach tolerance limits, during operations in environments above 75 F. Author (GRA)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N77-14742*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A WALKING BOOT ASSEMBLY Patent Application

Hubert C. Vykukal, Alan B. Chambers, and Roy H. StJohn, inventors (to NASA) Filed 23 Dec. 1976 17 p

(NASA-Case-ARC-11101-1; US-Patent-Appl-SN-753976) Avail: NTIS HC A02/MF A01 CSCL 05H

Spacers or liners inserted in the boot components of pressurized spacesuits impair foot ventilation and cause foot discomfort. A walking boot is described which includes a bootie adaptable to the foot of the wearer. A protuberance projected from the bootie fits within a recess in the inner sole of an hermetically sealed boot. Spring loaded latching bolts hold the bootie in place. Multiple wearers or astronauts with varying foot sizes can thus use a single spacesuit. NASA

N77-14743*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AN IMPROVED COOLING SYSTEM FOR REMOVING METABOLIC HEAT FROM AN HERMETICALLY SEALED SPACESUIT Patent Application

Bruce W. Webbon, Hubert C. Vykukal, and Bill A. Williams, inventors (to NASA) Filed 23 Dec. 1976 21 p

(NASA-Case-ARC-11059-1; US-Patent-Appl-SN-753978) Avail: NTIS HC A02/MF A01 CSCL 05H

A cooling and ventilating system is designed to achieve greater mobility with increased efficiency in removing metabolic heat, waste gases and water vapor from a spacesuit. The system includes an external life support system to which is attached a body suit with a liquid circulating circuit for establishing a cooling flow of water through the thorax and head sections of the body suit. A gas circulating circuit, including conduits and a helmet duct is provided for establishing a flow of gas throughout the spacesuit whereby gaseous wastes and water vapor are flushed from the suit. Heat, waste gases and water vapor ultimately are dissipated by the life support system. NASA

N77-14744# National Aeronautical Lab., Bangalore (India).

TIME DOMAIN AND TIME SERIES MODELS FOR HUMAN ACTIVITY IN COMPENSATORY TRACKING EXPERIMENTS

S. Balakrishna Mar. 1976 16 p refs

(Proj. IN-203)

(NAL-TN-50) Avail: NTIS HC A02/MF A01

Time domain modeling of human activity is investigated from compensatory tracking experiments invoking modern identification methodology. Various linear time invariant models in probabilistic situations are postulated to describe the pilot activity, and the associated problems of identification and estimation of these parametric models are detailed. Two classes of models are considered, an input-output based on a remanent term similar to quasi linear describing function models, and an innovative inaccessible input model based on concepts of time series analysis without remanent. Both classes of model are validated using experimentally generated data derived from a fixed base simulator. Author

N77-14745*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

TWELFTH ANNUAL CONFERENCE ON MANUAL CONTROL

Thomas E. Wempe May 1976 1001 p refs Conf. held at Urbana, Ill., 25-27 May, 1976

(NASA-TM-X-73170; A-6762) Avail: NTIS HC A99/MF A01 CSCL 05E

Main topics discussed cover multi-task decision making, attention allocation and workload measurement, displays and controls, nonvisual displays, tracking and other psychomotor tasks, automobile driving, handling qualities and pilot ratings, remote manipulation, system identification, control models, and motion and visual cues. Sixty-five papers are included with presentations on results of analytical studies to develop and evaluate human operator models for a range of control task, vehicle dynamics and display situations; results of tests of physiological control systems and applications to medical problems; and on results of simulator and flight tests to determine display, control and dynamics effects on operator performance and workload for aircraft, automobile, and remote control systems. Author

N77-14746# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.

HUMAN PERFORMANCE UNDER ACCELERATION: ACTUATION OF EJECTION SEAT LOWER FIRING CONTROL Final Report, 9 Dec. 1974 - 30 Jun. 1975

William P. Orrick, Jr., Phyllis E. York, and Malcolm M. Cohen 18 Mar. 1976 44 p

(AD-A025373; NADC-75268-40) Avail: NTIS HC A03/MF A01 CSCL 01/2

Sixteen male subjects attempted to actuate the lower firing control of an ejection seat using only the left hand while exposed to accelerations simulating several flight conditions. A human centrifuge was used to produce accelerations representative of level flight, dive recovery, dive recovery with buffet, cold catapult stroke, braking, inverted flight, spin and skid. In addition, fifty-four male and eight female subjects performed the task at 1 Gz, using three methods of gripping the firing control. Sample data and population estimates of pull forces for the various conditions are presented. Time data for task performance under acceleration and anthropometric data and force data are given. Author (GRA)

N77-14747# Air Force Human Resources Lab., Brooks AFB, Tex.

HUMAN RESOURCES AS ENGINEERING DESIGN CRITERIA

William B. Askren Mar. 1976 12 p refs

(AF Proj. 1124)

(AD-A024676; AFHRL-TR-76-1) Avail: NTIS HC A02/MF A01 CSCL 05/5

The results of a number of studies which have been performed in an attempt to develop a technology for using human resources data as criteria in engineering design studies are summarized. Eight investigations conducted during the period 1966-1975 are briefly described. The results of the eight studies are integrated around six topics feasibility and practicality of using human resources data as criteria in engineering design, methods for using the data in design studies, effect on the system of using the data as design criteria, types of human resources data most relevant for use as design criteria, methods for generating human resources data for use in design studies, and nature of the engineering design process. Author (GRA)

N77-14748# Air Force Human Resources Lab., Brooks AFB, Tex.

CONTINUATION VERSUS RECURRENT PILOT TRAINING Final Report, Nov. 1974 - Oct. 1975

James F. Smith and William G. Matheny (Life Sciences, Inc., Hurst, Texas) May 1976 14 p refs

(AD-A025846/7; AFHRL-TR-76-4) Avail: NTIS HC A02/MF A01 CSCL 05/9

Literature on the retention of motor, procedural and communication skills judged relevant to pilot training is surveyed. Also included are data concerning more recent pilot recurrent training information available from the United States Air Force, the United States Army and the Federal Aviation Agency. Implications of these data for USAF continuation pilot training are discussed, and an approach to obtaining more specific information is recommended. Author (GRA)

N77-14749# Pennsylvania State Univ., University Park. Environmental Acoustics Lab.

EVALUATION OF SPEECH PROCESSING SYSTEMS EVALUATION OF ELECTRONIC/ACTIVE HEARING PROTECTORS FOR USE IN UNDERGROUND COAL MINES Final Report

Paul L. Michael, James H. Prout, Gordon R. Bienvenue, Roger L. Kerlin, Sara Singer, George Kreick, and Anne Kohut May 1976 151 p refs

(Grant DI-BM-G0-155032)

(PB-256786/5; BM-OFR-96-76) Avail: NTIS HC A08/MF A01 CSCL 06Q

A discussion of performance parameters for electronic or active hearing protectors that will meet the needs of underground coal miners is presented. This information is incorporated into a proposed set of specifications that can be used to judge the suitability of a particular electronic hearing protector for the coal mine application. Acoustic and electrical tests were performed on a developmental model of an electronic hearing protector. A commercially active hearing protector, the British-built ACOS A-9000/2, was also examined. GRA

N77-14750# Naval Postgraduate School, Monterey, Calif.

PILOT REPORTED HUMAN FACTOR COCKPIT DISCREPANCIES IN NAVAL AIRCRAFT M.S. Thesis

Gene Leroy Daniels Mar. 1976 41 p refs

(AD-A026326) Avail: NTIS HC A03/MF A01 CSCL 01/3

This thesis investigates the problems in current naval aircraft cockpits as perceived by fleet naval aviators who are students at the U.S. Naval Aviation Safety School. A critical incident questionnaire provides data that examines the deficiencies of an individual aircraft. These individual aircraft deficiencies are then categorized into twelve major deficiency categories which are common to more than one aircraft. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N77-14751* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TWO-DIMENSIONAL RADIANT ENERGY ARRAY COMPUTERS AND COMPUTING DEVICES Patent

David H. Schaefer and James P. Strong, inventors (to NASA) Issued 7 Dec. 1976 31 p Filed 8 May 1974

(NASA-Case-GSC-11839-1; US-Patent-3,996,455; US-Patent-Appl-SN-468614; US-Patent-Class-235-152; US-Patent-Class-250-227; US-Patent-Class-340-172.5; US-Patent-Class-350-96R) Avail: US Patent Office CSCL 09B

Two dimensional digital computers and computer devices operate in parallel on rectangular arrays of digital radiant energy optical signal elements which are arranged in ordered rows and columns. Logic gate devices receive two input arrays and provide an output array having digital states dependent only on the digital states of the signal elements of the two input arrays at corresponding row and column positions. The logic devices include an array of photoconductors responsive to at least one of the input arrays for either selectively accelerating electrons to a phosphor output surface, applying potentials to an electroluminescent output layer, exciting an array of discrete radiant energy sources, or exciting a liquid crystal to influence crystal transparency or reflectivity. Official Gazette of the U.S. Patent Office

N77-14752 Rhode Island Univ., Kingston.
HIGH-SPEED ANALYSIS OF RELIABLE LIFE DATA USING COMPUTER INTERACTIVE GRAPHICS Ph.D. Thesis
Asa Sanford Davis, Jr. 1976 277 p
Avail: Univ. Microfilms Order No. 76-25530

A model was developed to combine the best features of graphical and analytical methods. The model employs a computer graphics display console and is capable of analyzing complete and censored data from exponential, normal, log-normal, extreme value and Weibull populations. The graphical procedure used is the method of hazard plotting and is well suited to censored data. The analytical routines include the method of maximum likelihood and best linear unbiased and invariant estimation. The model was applied to time to repair data for a general purpose computer, and the analysis confirmed a log normal argument. It was also applied to data from 75 ST aluminum alloy and SAE 4340 steel fatigue tests. Failure data for a silver cadmium battery used to power an underwater mobile target were also analyzed. Dissert. Abstr.

N77-14753*# Bi Ra Systems, Inc., Albuquerque, N. Mex.
FEASIBILITY STUDY OF THE DESIGN OF BI RA SYSTEMS, INCORPORATED MODEL 5301, 5101, AND 3222 CAMAC MODULES FOR SPACE USE Final Report, Feb. - Mar. 1976
Lavon Biswell and Robert McElderry 9 Apr. 1976 45 p
(Contract NAS5-22856)
(NASA-CR-144831) Avail: NTIS HC A03/MF A01 CSCL 09B

Cost estimates are determined for redesigned modules. Consideration is given to incorporation of NASA approved components, component screening and documentation, as well as reduced power consumption. Results show that r designed modules will function reliably in a space environment of 50 C and withstand greater than 15 G's of random vibration between 40 Hz and 400 Hz. Author

N77-14754# Los Alamos Scientific Lab., N.Mex.
MICROPROCESSOR UNIT FOR EXPERIMENTAL PROCESS DATA
C. D. Ethridge 1976 17 p refs Presented at Symp. on Trends and Applications Micro and Mini Systems, Gaithersburg, Mo., 27 May 1976
(Contract W-7405-eng-36)
(LA-UR-76-380; Conf-760507-1) Avail: NTIS HC A02/MF A01

Microprocessor application to data acquisition system control established a novel approach to monitoring processes utilizing test equipment with diverse output characteristics. The following aspects of the system are considered: data acquisition configuration; measurement instrument interfaces; I/O requirements to digital counter, digital multimeter, and terminal; software implementation; software program; and MPU system checkout. This microprocessor system data acquisition system generated, every five seconds, a hard copy for immediate data observation and stored data on magnetic tape cassette for subsequent transmission to central computing facilities for statistical evaluation. The program required approximately 3,300 program storage memory locations and 100 temporary storage locations to complete the data acquisition requirement for this experimental process. Author (ERA)

N77-14755# Naval Postgraduate School, Monterey, Calif.
EVALUATION OF THE DIRECT VIEW STORAGE DISPLAY FOR SIGNAL ANALYSIS M.S. Thesis
William A. Fuson Mar. 1976 82 p
(AD-A025415) Avail: NTIS HC A05/MF A01 CSCL 09/2

The visual processing of received radio and acoustic frequency spectrum data by human analysts forms an important portion of our current defense efforts. Both of these areas present many of the same basic problems to the analyst. These problems center on discovering the most effective means of presenting the data to a human observer for investigation. The basis of this thesis is a system developed at the Naval Postgraduate School, which has been labeled SPOTLIGHT (Signal Processing of Time Lines by Graphics Techniques), that gives an alternative to the lofargram approach. SPOTLIGHT as originally implemented utilized a rather extensive hardware layout both in terms of physical size and expense. The work described herein comprises the beginning of an effort to analyze the capabilities of more modern, less expensive and smaller equipment in the SPOTLIGHT environment. GRA

N77-14756# Logicon, Inc., San Diego, Calif.
ADAPT I UNIFORM DATA LANGUAGE (UDL): A PRELIMINARY SPECIFICATION Interim Report, 1 May - 1 Aug. 1976
M. E. Soleglad 23 Jul. 1976 123 p
(Contract N00014-76-C-0899)
(AD-A027580) Avail: NTIS HC A06/MF A01 CSCL 09/2

Under the ADAPT project, a prototype intelligent terminal will be developed which provides users and/or other systems a uniform interface for accessing multiple online data bases located on different systems. The underlying technology applied by ADAPT will be the transformation from one uniform data language, UDL, to other target query languages which reside on a network. ADAPT will be comprised of four phases: ADAPT I will provide the fundamental ADAPT system architecture baseline for subsequent phases and also a limited user data base query and display facility for four data base management systems. ADAPT II will provide users a data base maintenance facility for four DBMSs, as well as data display enhancements. ADAPT III will produce two production models of ADAPT, one installed in network centers and the other as a stand-alone intelligent terminal. ADAPT IV will provide a local data base manager for onsite file creation. Author (GRA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N77-14757 Polish Academy of Sciences, Warsaw.
ALGORITHM AND PROGRAM OF A CERTAIN GAME [ALGORYTM I PROGRAM PEWNEJ GRY]
Wlodzimierz J. Prosnak 17 Mar. 1976 73 p refs In POLISH
Avail: Issuing Activity

The object of consideration is the algorithm of a certain two person game with unequal changes played on a conventional chess board and called game of wolf and sheep. A game program in the language ALGOL 1204 corresponds to the algorithm constructed on the basis of an analysis of a tree of the game. The program is inserted in the project and is organized in such a way that successive movements of the wolf are initiated manually from the monitor of the Odra 1204 computer; successive moves of the sheep on the other hand are established automatically using the program. The program therefore has the form of a conversational program. At the end of the work, certain conclusions of a general nature are presented. Author

N77-14758 Stanford Univ., Calif.
ANALYSIS OF LANGUAGES FOR MAN-MACHINE VOICE COMMUNICATION Ph.D. Thesis
Robert Gary Goodman 1976 168 p
Avail: Univ. Microfilms Order No. 76-26002

An analysis of ambiguity, restriction and complexity in speech understanding system language is presented. Measures are

developed which permit the relative comparison of the difficulties of a given set of recognition tasks. Notions of equivalent vocabulary size, branching factor, effective branching factor, search space size and search space reduction are described. The important contribution is that it provides a way to characterize the relative difficulties and accomplishments of different speech understanding systems. Dissert. Abstr.

N77-14759 Stanford Univ., Calif.
OVERCOMING WORD LENGTH LIMITATIONS IN MINICOMPUTER AIDED CIRCUIT ANALYSIS Ph.D. Thesis
Julian Payne Freret, Jr. 1976 152 p
Avail: Univ. Microfilms Order No. 76-25996

Three principal sources of minicomputer roundoff errors are identified. Algorithmic improvements which virtually eliminate these errors are demonstrated. One of these improvements is a two-stage approach Newton-Raphson iteration which is shown to be extremely effective. A minicomputer program which incorporates the algorithmic improvements has been used to calculate the dc operating points of ten benchmark circuits. Dissert. Abstr.

N77-14760 Texas Univ., Austin.
UNOBTRUSIVE PROBLEM SOLVING MONITORS AND THEIR APPLICATION TO COMPUTER-ASSISTED INSTRUCTION Ph.D. Thesis
Jack Timothy Baldwin 1976 214 p
Avail: Univ. Microfilms Order No. 76-26590

Two prototype systems that have been implemented in the areas of cryptaddition and plane geometry are described. The results of a feasibility study involving the two implemented systems in which the students attempted to solve a variety of cryptaddition and plane geometry problems under various constraints are also described. The results of this study indicate that the two systems can effectively interact with students in a problem solving environment. Dissert. Abstr.

N77-14761 California Univ., Los Angeles.
METAFOR-A VERIFIED, PORTABLE TRANSLATOR WRITING SYSTEM Ph.D. Thesis
John Emerson Heiser 1976 652 p
Avail: Univ. Microfilms Order No. 76-25204

Three separate software engineering research areas, translator writing systems, program portability, and program verification, are combined in the design. A philosophy and methodology of informal program verification is developed and applied in the verification of the METAFOR translator. The technique is offered as a realistic compromise between formal program correctness techniques and the haphazard methods by which most programs are currently checked prior to testing and use. Dissert. Abstr.

N77-14762 Stanford Univ., Calif.
THE ANALYSIS OF HASHING ALGORITHMS Ph.D. Thesis
Leonidas John Guibas 1976 136 p
Avail: Univ. Microfilms Order No. 76-26005

The performance of hashing algorithms to the notion of clustering, that is the pile-up phenomenon that occurs because many keys may probe the table locations in the same sequence, is asymptotically equivalent to the performance of uniform probing, a method that exhibits no clustering and is known to be optimal in a certain sense. The tail of the hypergeometric distribution a fixed percent away from the mean is exponentially small. Random subsets of the finite ring of integers modulo m of a fixed density have always nearly the expected number of arithmetic progressions of length k, except with exponentially small probability. This theorem is used to start up a process (called the extension process) of looking at snapshots of the table as it fills up with double hashing. Between steps of the extension process it is shown that the effect of clustering is negligible. Dissert. Abstr.

N77-14763*# Kanner (Leo) Associates, Redwood City, Calif.
INSTRUCTIONS FOR SERVICING AND OPERATION OF THE VODRZ PROGRAM. PART 1: ALGORITHMIC DESCRIPTION OF THE VODRZ PROGRAM. PART 2: TECHNICAL DESCRIPTION 1., TECHNICAL DESCRIPTION 2
Washington NASA Dec. 1976 103 p Transl. into ENGLISH of the report "Instruktsiya po obsluzhivaniyu i rabote programmy BODRZ, chast' I. Algoritmicheskoye opiisaniye programmy BODRZ, chast' II. Tekhnicheskoye opisaniye 1. Teknicheskoya opisaniye 2" Central Aerological Observatory, USSR, 1975 104 p
(Contract NASw-2790)
(NASA-TT-F-17510) Avail: NTIS HC A06/MF A01 CSCL 09B

Instructions for using the VODRZ (secondary processing of rocket probe data) program are given. Included are descriptions of the initial data, radar and telemetry data, primarily on altitudes temperatures and pressures, the algorithms used in processing the data and the constants involved in processing the data in a Minsk-32 computer. A print out of the VODRZ program and its associated subroutines and subprograms, as well as the sequence of commands for loading the program on to magnetic tape, running the program, putting the initial data on punch cards and tables of the constants used are presented. Author

N77-14764# Virginia Polytechnic Inst. and State Univ., Blacksburg. Div. of Materials Engineering.
ITERATIVE AND FINITE DIFFERENCE COMPUTER PROGRAMS FOR DIFFUSION IN SINGLE AND TWO PHASE SYSTEMS Final Report
J. Unnam and C. R. Houska Jan. 1976 105 p refs
(Grant NSF GH-30180)
(PB-256282/5; NSF-GH-30180A-1) Avail: NTIS HC A06/MF A01 CSCL 07D

Four computer programs are included which describe atomic diffusion in finite, single, and two-phase systems. They are restricted to planar, one-dimensional systems. However, the diffusion coefficient may vary continuously with composition and need not be fitted to special functions. Consequently, smoothed experimental coefficients can be used as input. Two of the programs are iterative solutions based upon modified Boltzmann integral functions. Both require two to three magnitudes less computer time than the corresponding finite-difference calculations and are readily used to determine diffusion coefficients by a trail and error fitting of the composition profile. Two finite difference programs are also included which treat the same problem conditions. GRA

N77-14765# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
NLP SENSITIVITY ANALYSIS FOR RHS PERTURBATIONS. A BRIEF SURVEY AND SECOND-ORDER EXTENSIONS Interim Technical Report
Robert L. Armacost and Anthony V. Fiacco 20 Apr. 1976 66 p refs
(Grant DAAG29-76-G-0150)
(AD-A026976; Serial-T-334; ARO-13622.1-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

The paper first presents a brief historical survey of the introduction of Lagrange multipliers in characterizing optimality and duality in mathematical programming. Attention is focused on the interpretation of optimal Lagrange multipliers as a first-order measure of the sensitivity of the optimal value function of the problem with right-hand side perturbations of the constraints. For the latter problem, explicit formulas are then obtained for calculating the first derivatives of a Kuhn-Tucker triple, resulting in second-order characterizations of the optimal value function. Approximation formulas are developed for the algorithm based on the logarithmic-quadratic penalty function. Applications are indicated, e.g., in obtaining sharper estimates of the optimal value of a problem with different constraint right-hand sides, in applying a well known approach to solving a class of large-scale decomposable nonlinear programming problems, and in supplementing the rich theoretical developments associated with a first-order analysis of the optimal value function of the problem with perturbations in the right-hand sides of the constraints. Author (GRA)

N77-14766# Stanford Univ., Calif. Optimization Lab.
ON SOLVING LINEAR COMPLEMENTARITY PROBLEMS AS LINEAR PROGRAMS
Richard W. Cottle and Jong-Shi Pang Mar. 1976 52 p refs
(Contracts N00014-75-C-0267; E(04-3)-326; NR Proj. 047-064)
(AD-A025725; SU-SOL-76-5) Avail: NTIS HC A04/MF A01 CSCL 12/2

Recently, the idea of solving certain classes of linear complementarity problems as linear programs was discussed. The present paper (1) demonstrates how these complementarity problems are related to the theory of polyhedral sets having least elements and (2) discusses the question of whether the linear programming approach can be recommended for solving them. GRA

N77-14767# Stanford Univ., Calif. Optimization Lab.
DESIGN AND TESTING OF A GENERALIZED REDUCED GRADIENT CODE FOR NONLINEAR PROGRAMMING
L. S. Lasdon, A. D. Waren, Arvino Jain, and Margery Ratner Feb. 1976 51 p refs
(Contracts N00014-75-C-0267; N00014-75-C-0865; E(04-3)-326; Grant NSF DCR-75-04544; NR Proj. 047-064; NR Proj. 047-143)
(AD-A025724; SU-SOL-76-3) Avail: NTIS HC A04/MF A01 CSCL 12/2

The purpose of this paper is to describe a Generalized Reduced Gradient (GRG) algorithm for nonlinear programming, its implementation as a FORTRAN program for solving small to medium size problems, and some computational results. Our focus is more on the software implementation of the algorithm than on its mathematical properties. This is in line with the premise that robust, efficient, easy to use NLP software must be written and made accessible if nonlinear programming is to progress, both in theory and in practice. Author (GRA)

N77-14768# Stanford Univ., Calif. Optimization Lab.
A CONDENSATION ALGORITHM FOR A CLASS OF ALGEBRAIC PROGRAMS
Mordecai Avriel and Victoria Gurovich (Technion, Israel Inst. of Technology, Haifa) Nov. 1975 23 p refs Sponsored in part by IBM and the Gerald Swope Research Fund
(Contracts N00014-75-C-0865; AT(04-3)-326; NR Proj. 047-143)
(AD-A025723; SU-SOL-75-28) Avail: NTIS HC A02/MF A01 CSCL 09/2

A class of algebraic programs, illustrated by examples in optimal location-allocation problems, discrete approximations and multiplier methods, is presented. This class can be characterized by objective and constraint functions consisting of absolute values of rational functions of polynomials raised to positive powers. Next, an algorithm consisting of monomial condensations and cutting planes, extending the Avriel-Williams complementary geometric programming method, is derived. Author (GRA)

N77-14769# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
STRUCTURED PROGRAMMING AND DEBUGGING AIDS WITH MACRO-11 ASSEMBLY LANGUAGE FOR THE PDP-11 COMPUTER
S. W. Kahng Apr. 1976 30 p
(Contract N00017-72-C-4401)
(AD-A025713; APL/JHU/TG-1294) Avail: NTIS HC A03/MF A01 CSCL 09/2

The following macro instructions are described for use with the MACRO-11 assembly language on the PDP-11 computer: IF, WHILE, REPEAT-UNTIL, FOR, CALL, RETURN, LEAVE, and CASE. In addition, LIST, DUMP, and TRACE capabilities are provided along with library subroutines. With these descriptions, a reasonable macro processing language can be used to develop macro instructions that provide many of the conveniences of a high-level programming language. Author (GRA)

N77-14770# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
PROTOSYSTEM 1: AN AUTOMATIC PROGRAMMING SYSTEM PROTOTYPE
Gregory R. Ruth Jul. 1976 34 p refs
(Contract N00014-75-C-0661)
(AD-A026912; MIT-LCS/TM-72) Avail: NTIS HC A03/MF A01 CSCL 09/2

A model of the data processing system writing process is given in terms of development stages. These stages correspond to the progression in the implementation and design process from the highest level of abstraction (English system specifications) to the lowest level (machine code). The issues and goals (including optimization of the product data processing systems) involved in automating these stages are discussed, and strategies and methodologies used for doing so are developed. Protosystem 1, an automatic programming system prototype, is described. The completed (and working) part automates three of the five stages identified in the proposed model of the system writing process. The basic theory, methods and structure of this part of the automatic programming systems are presented. Author (GRA)

N77-14771# Systems Control, Inc., Palo Alto, Calif.
DESIGN OF THE SOFTWARE STRUCTURE FOR A SIGNAL PROCESSING TEST BED
E. A. Adams, III, W. J. Bangs, II, and M. J. Hannah 31 Dec. 1975 177 p
(Contract N00014-75-C-1039)
(AD-A026390; TM-5137-200-1) Avail: NTIS HC A09/MF A01 CSCL 09/3

This document describes a functional specification of system software to support the creation and execution of signal processing processes on a digital computer system. GRA

N77-14772# Stanford Univ., Calif. Systems Optimization Lab.
THE SOLUTION OF NONLINEAR PROGRAMS USING THE GENERALIZED REDUCED GRADIENT METHOD
Arvind Jain Mar. 1976 134 p refs
(Contracts N00014-75-C-0267; N00014-75-C-0865; NR Proj. 047-064; NR Proj. 047-143)
(AD-A025726; SUSOL-76-6) Avail: NTIS HC A07/MF A01 CSCL 12/2

The Generalized Reduced Gradient Method for nonlinear programming is discussed with emphasis on a fast, reliable computer implementation of the algorithm. The problems studied relate to basis selection, degeneracy, the acceleration of the solution of nonlinear equations, and the design of a mathematical programming system for sparse large scale nonlinear programs. Author (GRA)

N77-14773# Stanford Univ., Calif. Dept. of Computer Science.
AUTOMATIC PROGRAM VERIFICATION V: VERIFICATION-ORIENTED PROOF RULES FOR ARRAYS, RECORDS, AND POINTERS
David Luckham and Norihisa Suzuki Mar. 1976 52 p refs
(Contract DAHC15-73-C-0435; ARPA Order 2494)
(AD-A027455; SU-STAN-CS-76-549; AIM-278) Avail: NTIS HC A04/MF A01 CSCL 09/2

A practical method is presented for automating in a uniform way the verification of Pascal programs that operate on the standard Pascal data structures ARRAY, RECORD, and POINTER. New assertion language primitives are introduced for describing computational effects of operations on these data structures. Axioms defining the semantics of the new primitives are given. Proof rules for standard Pascal operations on pointer variables are then defined in terms of the extended assertion language. Similar rules for records and arrays are special cases. An extensible axiomatic rule for the Pascal memory allocation operation, NEW, is also given. These rules have been implemented in the Stanford Pascal program verifier. Examples illustrating the verification of programs which operate on list structures implemented with pointers and records are discussed. These include programs with side-effects. GRA

N77-14774# Stanford Univ., Calif. Dept. of Computer Science.
THE THEORETICAL ASPECTS OF THE OPTIMAL FIXED-POINT
Zohar Manna and Adi Shamir Mar. 1976 26 p refs
(Contract DAHC15-73-C-0435; ARPA Order 2494)
(AD-A027454; SU-STAN-CS-76-542; SU-AIM-277) Avail: NTIS HC A03/MF A01 CSCL 09/2

In this paper the authors define a new type of fixedpoint of recursive definitions and investigate some of its properties. This optimal fixedpoint (which always uniquely exists) contains, in some sense, the maximal amount of 'interesting' information which can be extracted from the recursive definition, and it may be strictly more defined than the program's least fixedpoint.

This fixedpoint can be the basis for assigning a new semantics to recursive programs. GRA

N77-14775# Naval Surface Weapons Center, Dahlgren, Va.
SURVEY OF SOFTWARE DEVELOPMENT TECHNOLOGY AT THE NAVAL SURFACE WEAPONS CENTER, DAHLGREN LABORATORY
Robert Hein Jul. 1976 27 p
(AD-A027451; NSWC/DL-TR-3511) Avail: NTIS HC A03/MF A01 CSCL 09/2

Systems being developed at the Naval Surface Weapons Center, Dahlgren Laboratory (NSWC/DL), have benefitted from the formulation and refinement of techniques and technologies used in software development. Many ideas have been considered, implemented, improved, or rejected during the thirty years of developing software at the Dahlgren Laboratory. Some of the more important concepts that are used in the software development process are simulation modeling of hardware/software systems, program design language and structured programming languages, wrap-around simulations and instrumented emulators, and dedicated software support sites. These design and analysis tools and methodologies, when judiciously used, have helped to produce quality software at NSWC/DL. Author (GRA)

N77-14776# Mitre Corp., Bedford, Mass.
RESEARCH AND DEVELOPMENT NEEDS FOR COMPUTER PERFORMANCE EVALUATION
J. A. Maskin Jun. 1976 57 p refs
(Contract F19628-76-C-0001; AF Proj. 572C)
(AD-A026965; MTR-3108; ESD-TR-76-142) Avail: NTIS HC A04/MF A01 CSCL 09/2

Computer performance evaluation (CPE) will continue to have a major impact on new and existing computer systems within the Air Force. To identify areas where potentially significant benefits might accrue, an investigation of present CPE tools and techniques as well as those not available or generally not applied inside the Air Force was initiated. Four broad areas which relate to computer system performance were investigated: cost as a measure of performance, system architectures and their impact on CPE, CPE considerations of data base management systems, and computer facility operational and procedural CPE factors. Expansion of CPE to facility management is identified as a major area of performance improvement potential. Recommendations are given for a number of follow-on investigations. GRA

N77-14777# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
OPTIMAL SEARCHING ALGORITHMS FOR PARALLEL-PIPELINED COMPUTERS
Daniel Lee Weller Jun. 1976 173 p refs
(Contract DAAB07-72-C-0259; Grant NSF GJ-40584)
(AD-A027421; R-730; UILU-ENG-76-2218) Avail: NTIS HC A08/MF A01 CSCL 09/2

A new class of optimal search algorithms is presented for the classical problem of searching an ordered list. The appropriate algorithm is selected as a function of the order, (s,p), of the target processor which may consist of p parallel processors each of which is an s level pipelined processor. The algorithms, called W-searches, are structured according to a new integer series, the W-series. The W-searches include the binary search for processors of order (1,1), the Fibonacci search for processors of order (2,1), and well-known parallel searches for processors of order (1,p). Author (GRA)

N77-14778# Federal COBOL Compiler Testing Service, Washington, D.C.
DATA GENERAL C-300 ECLIPSE COBOL PRE-RELEASE 0.0.5 Validation Summary Report
1 Jul. 1976 48 p
(AD-A027427; CCVS74-VSR150) Avail: NTIS HC A03/MF A01 CSCL 09/2

This Validation Summary Report (VSR) provides a consolidated summary of the results obtained from the validation of the subject compiler. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by Federal level module; a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. Author (GRA)

N77-14779# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DEVELOPMENT OF A COMMUNICATIONS ORIENTED LANGUAGE Final Report, May 1975 - Mar. 1976
20 Mar. 1976 201 p refs
(Contract DCA100-75-C-0051)
(AD-A027519; BBN-3261-Pt-1) Avail: NTIS HC A10/MF A01 CSCL 09/2

A Communications Oriented Language (COL) is a high order language designed to be maximally effective as a vehicle with which to program communications applications. This document is a preliminary description of a design for a COL. The design philosophy and principles that led to the COL are first discussed. Then the language is described, the syntax semi-formally using modified BNF and the semantics informally in English text. Some examples of COL programming are included. An appendix shows how machine-level instructions for a specific machine can be written in the COL, with an example showing interrupt processing. GRA

N77-14780# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DEVELOPMENT OF A COMMUNICATIONS ORIENTED LANGUAGE. TASK 2: DEVELOPMENT OF THE COL CONCEPT AND SYNTAX, PART 2 Final Report, May 1975 - Mar. 1976
Arthur Evans, Jr. and C. Robert Morgan 20 Mar. 1976 168 p
(Contract DCA100-75-C-0051)
(AD-A027523; BBN-3261-Pt-2) Avail: NTIS HC A08/MF A01 CSCL 09/2

A Communications Oriented Language (COL) is a high order language designed to be maximally effective as a vehicle with which to program communications applications. This document is a preliminary description of a design for a COL. The design philosophy and principles that lead to the COL are first discussed. Then the language is described, the syntax semi-formally using modified BNF and the semantics informally in English text. Some examples of COL programming are included. An appendix shows how machine-level instructions for a specific machine can be written in the COL, with an example showing interrupt processing. GRA

N77-14055*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STANDARD RANDOM NUMBER GENERATION FOR MBASIC
R. C. Tausworthe *In its* The Deep Space Network 15 Dec. 1976 p 58-62 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 09B

N77-14056*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE FAST DECODING OF REED-SOLOMON CODES USING FERMAT THEORETIC TRANSFORMS AND CONTINUED FRACTIONS
L. R. Welch (Univ. of Southern Calif.), I. S. Reed (Univ. of Southern Calif.), and T. K. Truong *In its* The Deep Space Network 15 Dec. 1976 p 63-74 (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 09B

N77-14057*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE FAST DECODING OF REED-SOLOMON CODES USING HIGH-RADIX FERMAT THEORETIC TRANSFORMS
K. Y. Liu (Univ. of Southern Calif.), I. S. Reed (Univ. of Southern Calif.), and T. K. Truong *In its* The Deep Space Network 15 Dec. 1976 p 75-80 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 09B

N77-14060*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TWO MBASIC PROGRAMS THAT WRITE APPLICATION PROGRAMS FOR ACCESSING A DATABASE
R. M. Smith *In its* The Deep Space Network 15 Dec. 1976 p 105-113 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N77-14781 Stanford Univ., Calif.
CUTTING PLANES AND SELF-CHECKING NETWORKS Ph.D. Thesis
Stephen George Kolupaev 1976 213 p
Avail: Univ. Microfilms Order No. 76-26028

Results on acyclic, combinational self checking networks are presented. These networks include the well known totally self checking and morphic networks. A cutting plane is a set of cuts of a network, which cuts every path from input to output exactly once. A cutting plane divides an acyclic net into an input half and an output half. It defines an interface where the coded internal signals of a self checking network can be studied. The survey covers all maps between all codes on 4 variables or less. The 170 million cases encompassed are reduced to about 10,000 by considering equivalence of codes and maps under permutation and complementation of variables. Dissert. Abstr.

N77-14782 Illinois Univ., Urbana.
THE DESIGN OF TOTALLY SELF-CHECKING SYSTEMS Ph.D. Thesis
David Su-Ming Ho 1976 107 p
Avail: Univ. Microfilms Order No. 76-24103

A totally self checking system is a digital system consisting of functional units and hardware checkers interconnected so that faults are detected and indicated as soon as they affect system operation. A general purpose minicomputer is redesigned to be totally self checking. This redesign involves the selection of fault modes and corresponding encodings for each of the functional units, the design of functional units, the design of a microprogrammed totally self checking control sequencer, and the architectural arrangement of functional units and checkers to achieve a totally self checking system. Dissert. Abstr.

N77-14783 Texas Univ., Austin.
COMPUTER SYSTEM MODELS WITH PASSIVE RESOURCES Ph.D. Thesis
Thomas Walter Keller, Jr. 1976 168 p
Avail: Univ. Microfilms Order No. 76-26647

A class of queueing network models of computer systems with the characteristic of simple solutions is extended to include memory, channels, and input/output processors. One technique also extends the class of models to include more realistic service time distributions. It is shown that the techniques are general enough to apply to a number of queueing network models with a fixed limit on the level of parallelism in a subnetwork of the model. Patterning in workload characterization is studied with file references and resource requests as examples. The consequences of patterning to memory management strategies for a library file system are determined by analysis of empirical reference traces. Dissert. Abstr.

N77-14784 Stanford Univ., Calif.
ERROR MANAGEMENT IN DIGITAL COMPUTER INPUT/OUTPUT SYSTEMS Ph.D. Thesis
Alan Michael Usas 1976 426 p
Avail: Univ. Microfilms Order No. 76-26086

Techniques of error management (those steps taken to limit the effect of errors and to expedite recovery) appropriate for the buses, interfaces, controllers, and peripheral devices of the I/O system are discussed. A flexible maintenance bus is suggested as a solution to the problem of simplifying the human involvement with I/O system fault diagnosis. This bus, which is physically attached to a suspected faulty piece of equipment, acts like a programmable waveform generator and response recorder. It gives diagnostic programs access to a multiplicity of low level points in the I/O system not directly reachable by means of the standard I/O bus. Dissert. Abstr.

N77-14785 Wisconsin Univ., Madison.
ON FAULT DIAGNOSIS OF SYNCHRONOUS SEQUENTIAL LOGIC NETWORKS WITH MODE CONTROL Ph.D. Thesis
Louis Gwo-Jiun Chu 1976 159 p
Avail: Univ. Microfilms Order No. 76-18871

A network design approach with built-in special test paths and mode-control switches in each module (a basic replaceable logic circuit unit) is presented for easing fault diagnosis of synchronous sequential logic networks. To test a network, all of the faults associated with the special test paths, which include all the memory faults and most of the external connection and bonding faults, are detected and located. When all the special test paths are functioning properly, another set of tests is applied to detect or locate all of the ramaining faults. If originally the fault locatability is not satisfactory, inserting or deleting a few branches in the test mode may improve the fault locatability up to a satisfactory level. The proposed modifications to the network for easing of fault diagnosis are incorporated by insertion of additional modules into some of the intermodular wiring, by custom-cutting internal connections in the modules, or both. Dissert. Abstr.

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N77-14786 Illinois Univ., Urbana.
ON OPTIMAL CONTROL PROBLEMS WITH STATE-VARIABLE INEQUALITY CONSTRAINTS Ph.D. Thesis
Albert Lewis Hendricks 1976 92 p
Avail: Univ. Microfilms Order No. 76-24100

The state-variable inequality constrained optimal control problem is formulated as a standard optimal control problem with one additional constraint of the form S(x(t)) is less than or equal to 0. This constraint is assumed to be of p-th order where p is an integer and p is more than or equal to 1. The p-th time derivative of the constraint is the first to contain the control variable explicitly. The constraint serves to divide the state space into a feasible and an infeasible subspace and the optimization is forced to take place within a bounded region; i.e., the state trajectory must satisfy S(x(t)) is less than or equal to of at all time instants. The new trajectory constraints allow the constrained problem to be solved easily and with great accuracy using a multi-point boundary value approach whenever: (1) state dimension = constraint order = 1 and S(x) = 0 has a unique, time-invariant solution and (2) state dimension = constraint order = 2 and S(x) = 0 and S(x) = 0 together have a unique, time-invariant solution. Dissert. Abstr.

N77-14787 British Library Lending Div., Boston Spa (England).
THE EDITING OF SYMBOLIC DATA USING A CATHODE-RAY DISPLAY TUBE
V. M. Levin [1976] 13 p refs Transl. into ENGLISH from Gidromet. Nauch.-Issled. Tsentr. SSSR t. vyp. 144 (Leningrad), 1975 p 30-35 In RUSSIAN and ENGLISH
(BLL-M-24796-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The use of indicators displayed on cathode ray tubes is an important means of ensuring the reliable operation and flexible control of an automated system for processing graphical data (SPGD). Because the time diagram for the entire operation rules out repeated recordings, a specialist operator is required to control the graphical data before a start is made on recording them. The problem of an SPGD employing display is discussed. A programmed technique permitting dialogue processing of symbolic data is presented. The concept of alphanumeric data is widened to include meteorological values and other graphical elements used to compile charts as well as other graphic material used in forecasting. Author

N77-14788 Princeton Univ., N.J.
PARAMETER ESTIMATION IN TIME DELAY SYSTEMS Ph.D. Thesis
Douglas Cecil White 1976 314 p
Avail: Univ. Microfilms Order No. 76-25121

The on-line identification problem for systems involving unknown time delays is analyzed on simulation models chosen to be representative of real systems in an environment which includes realistic noise terms. Among methods proposed previously

for this problem, the following four were selected for extensive open loop trials -- input/output Fourier Analysis, the Extended Kalman Filter, discrimination between zero and non-zero parameters in an expanded model of the system and a direct search technique. The latter two were investigated with both recursive and batch processing algorithms involving Least Square and Maximum Likelihood decision criteria. Among these, the direct search technique using a batch algorithm gave the best results but had rather high computational requirements. An alternative approach based on a nonlinear parameter estimation algorithm with a discrete approximation to the delay derivative terms is shown to have reasonable convergence properties and modest computational requirements in a number of open loop tests on a variety of models. Dissert. Abstr.

N77-14789# Rockwell International Corp., Newport Beach, Calif. Collins Radio Group.
STUDY OF MULTI-STATE PN SEQUENCES AND THEIR APPLICATION TO COMMUNICATION SYSTEMS Progress Report, 1 Jan. - 15 Feb. 1976
Robert Gold 18 Feb. 1976 33 p refs
(Contract N00014-75-C-1040)
(AD-A026220; PR-5) Avail: NTIS HC A03/MF A01 CSCL 09/4

Substantial progress was made during the current reporting period which was devoted to the following areas: Further correlation properties of four-state sequences, implementation of four-state sequences in systems using correlation detectors, and spectral properties of four-state sequences. The cross-correlation function of any two maximal four-state sequences was determined in terms of the cross-correlation function of the binary sequences used to represent them. Two general formulas were obtained, each of which applies depending on whether the four-state sequences being correlated are of the same or opposite category. It was shown that the cross-correlation function of two maximal four-state sequences of opposite category is real valued. The mean square value of the cross-correlation function of any two maximal four-state sequences has been determined. GRA

N77-14790# Massachusetts Univ., Amherst. Dept. of Electrical and Computer Engineering.
OPTIMUM FILTERING OF CYCLOSTATIONARY PROCESSES RESULTING FROM SCANNING OR SAMPLING OF COMMUNICATION AND CONTROL SIGNALS Final Report
L. E. Franks May 1976 9 p refs
(Grant AF-AFOSR-2111-71; AF Proj. 9769)
(AD-A026358; AFOSR-76-0700TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

Random signal processes which have been subjected to some form of repetitive operation such as sampling, scanning or multiplexing will usually exhibit statistical properties which vary periodically with time. Specifically, a random process, x(t), for which the mean, E(x(t)), and the autocorrelation, E(x(t tau) x (t)), are both periodic in t is termed a cyclostationary process. It is shown that many of the signal processes typically encountered in communication systems and control systems are cyclostationary, a fact often ignored in the analysis of such systems. Using the more accurate cyclostationary model for such processes, a more precise evaluation of system performance can be obtained and signal processors giving superior performance can be designed. In particular, general procedures are developed for finding the optimum periodically-time-varying filters for the continuous waveform estimation problem and the improvement in performance is demonstrated over the best time-invariant filter. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N77-14791 Polish Academy of Sciences, Warsaw.
ON AN INITIAL PROBLEM FOR EQUATIONS OF LINEAR ELEKTRODYNAMICS OF DISPERSION MEDIUMS [O ZAGADNIENIU POCZATKOWYM DLA ROWNAN LINIOWEJ ELEKTRODYNAMIKI OSRODKOW DYSPERSYJNYCH]
Jacek Duniec 19 Dec. 1975 11 p refs In POLISH
Avail: Issuing Activity

Equations of linear electrodynamics of mediums with time dispersion are presented as equations describing a dynamic system in a suitable Banach space. The existence and univocal nature of the solution of these equations given the history of the electromagnetic field in the medium is proven. The continuous dependence of the solution on the history is demonstrated. The treatment of electrodynamic equations as dynamic systems has several unique characteristics. One of these is the possibility of applying general theorems on stability with the purpose of finding criteria to which a material equation must correspond in order that the electromagnetic field be stable. Author

N77-14792 Polish Academy of Sciences, Warsaw.
A QUALITATIVE STUDY OF A DIFFERENTIAL EQUATION WITH A DISCRETE FUNCTION [BADANIE JAKOSCIOWE ROWNANIA ROZNICZKOWEGO Z NIECIAGLA FUNKCJA]
Stefan Kotowski 23 Dec. 1975 11 p refs In POLISH
Avail: Issuing Activity

The subject of the work is a system of common differential equations written in matrix form in which a discontinuous vector function is inserted in a linear fashion. Concerning this function, we establish that it is continuous with zones and discontinuities appear only on certain surfaces S. We establish that discontinuities occurring on surfaces S are discontinuities of the first type, whereas the surfaces S are smooth. The study of peculiarities of solutions of equations with discontinuous functions requires different methods than the study of continuous functions. These are known as slide solutions. Equations of motion in slide are derived based on the work of A.F. Filippov. Author

N77-14793 Illinois Univ., Urbana.
A STUDY IN THE DESIGN OF AN ARITHMETIC ELEMENT FOR SERIAL PROCESSING IN A LINEAR ITERATIVE STRUCTURE Ph.D. Thesis
Lakshmi Narayana Goyal 1976 255 p
Avail: Univ. Microfilms Order No. 76-24090

The arithmetic design of the processing element is described with respect to the number representation, the definition of a normalized number and the algebraic design of the digit algorithms for the microinstructions necessary to implement the four basic arithmetic operations of floating point addition, subtraction, multiplication and division. The logic design of the various components of the processing element is developed to get an estimate of its gate and pin complexity. Formulas are given for the gate and pin complexities of the various components of the PE as a function of the type of 2 tuple logic vector encoding for a redundant binary digit, the bit width of the processing element (that is, the radix of arithmetic execution) and the amount of redundancy in the multiplier/quotient digit. Dissert. Abstr.

N77-14794 Ohio State Univ., Columbus.
THE CONSTRUCTION OF BINARY PATTERNS FROM MOMENTS, MOMENT INVARIANTS, AND PROJECTIONS Ph.D. Thesis
Eugene Leo Rissanen 1976 224 p
Avail: Univ. Microfilms Order No. 76-24674

The method involves constructing projections from the moments and, then, binary patterns from the projections. Sets of horizontal, vertical, and diagonal projections are derived from the moments. Some of these sets will be inconsistent, i.e., will correspond to no binary pattern. Tests for detecting many of these inconsistent projection sets are described. An algorithm is developed for constructing patterns from those projection sets which seem to be consistent. The algorithm compares favorably with other existing algorithms as indicated by several typical examples. Dissert. Abstr.

N77-14795*# Houston Univ., Tex. Dept. of Mathematics.
FEATURE COMBINATIONS AND THE DIVERGENCE CRITERION
Henry P. Decell, Jr. and Shailesh M. Mayekar Jun. 1976 13 p refs
(Contract NAS9-15000)
(NASA-CR-151131; Rept-56) Avail: NTIS HC A02/MF A01 CSCL 12A

Classifying large quantities of multidimensional remotely

sensed agricultural data requires efficient and effective classification techniques and the construction of certain transformations of a dimension reducing, information preserving nature. The construction of transformations that minimally degrade information (i.e., class separability) is described. Linear dimension reducing transformations for multivariate normal populations are presented. Information content is measured by divergence. Author

N77-14796*# Santa Clara Univ., Calif.
THE RELATION OF FINITE ELEMENT AND FINITE DIFFERENCE METHODS Final Technical Report, 1 Aug. 1975 - 31 Jul. 1976
Marcel Vinokur Washington NASA Dec. 1976 55 p refs
(Grant NsG-2086)
(NASA-CR-2764) Avail: NTIS HC A04/MF A01 CSCL 12A

Finite element and finite difference methods are examined in order to bring out their relationship. It is shown that both methods use two types of discrete representations of continuous functions. They differ in that finite difference methods emphasize the discretization of independent variable, while finite element methods emphasize the discretization of dependent variable (referred to as functional approximations). An important point is that finite element methods use global piecewise functional approximations, while finite difference methods normally use local functional approximations. A general conclusion is that finite element methods are best designed to handle complex boundaries, while finite difference methods are superior for complex equations. It is also shown that finite volume difference methods possess many of the advantages attributed to finite element methods. Author

N77-14797*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INTEGRALS OF A C-1-COMPATIBLE TRIANGULAR SURFACE ELEMENT
C. L. Lawson 15 Dec. 1976 20 p refs
(Contract NAS7-100)
(NASA-CR-149277; JPL-TM-33-808) Avail: NTIS HC A02/MF A01 CSCL 12A

Definite integrals are evaluated for the cardinal functions of an interpolation method which provides C sup 1 continuity over a triangular grid. Author

N77-14798# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
AN APPLICATION OF MAJORIZATION TO THE PROBLEM OF SELECTING THE LARGEST INTERACTION IN A TWO-FACTOR EXPERIMENT
Robert E. Bechhofer, Thomas J. Santner, and Bruce W. Turnbull May 1976 36 p refs
(Contracts DAHC04-03-C-0008; N00014-75-C-0586)
(AD-A025955/6; TR-292) HC A03/MF A01 CSCL 12/1

The problem of devising a single stage procedure for the goal of selecting the factor-level combination associated with the largest positive interaction is studied for the usual linear model underlying a 2-factor rxc experiment involving qualitative variables when the common variance is known. The main result is a theorem which gives this least favorable (LF)-configuration explicitly for the 2xc case; the principal tool used in the proof of the theorem is the theory of Schur concavity and majorization in multivariate distributions as described by Marshall and Olkin. Various generalizations are proposed. GRA

N77-14799# Stanford Univ., Calif. Dept. of Operations Research.
DIFFUSION BOUNDS FOR SOME PASSAGE PROBABILITIES IN THE THEORY OF STORAGE
J. Michael Harrison Feb. 1976 11 p refs
(Contract N00014-76-C-0418; Grant NSF GK-35491; NR Proj. 047-061)
(AD-A025728; SU-TR-60) Avail: NTIS CSCL 12/1

A storage process X(t) is considered with general jump size distribution, non decreasing state dependent output rate, and non increasing state dependent jump intensity. The object of the study is U(x), the probability that state zero is never reached when starting from state $x < 0$. The natural diffusion approximation for X(t) is identified. An explicit formula is known for U sub * of x, the probability that the approximating diffusion process never reaches state zero when starting from state $x > 0$. It is shown that U sub * less than or equal to U, and a conjecture is advanced regarding conditions under which this bound is tight. GRA

N77-14800# Stanford Univ., Calif. Dept. of Operations Research.
SECOND ORDER CHARACTERIZATIONS OF PSEUDO-CONVEX QUADRATIC FUNCTIONS
Siegfried Schaible Nov. 1975 17 p refs
(Contract N00014-75-C-0267; Grant NSF MPS-71-03341; NR Proj. 047-064)
(AD-A025727; SU-TR-75-29) Avail: NTIS HC A02/MF A01 CSCL 12/1

The paper deals with (strictly) pseudo-convex quadratic functions on open convex sets. It presents second order conditions in terms of an extended Hessian and in terms of bordered determinants. All the conditions are both necessary and sufficient. Author (GRA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N77-14801 Princeton Univ., N.J.
RECURSIVE ESTIMATION AND CONTROL OF NONLINEAR STOCHASTIC SYSTEM Ph.D. Thesis
Vincent Ping-wah Leung 1976 174 p
Avail: Univ. Microfilms Order No. 76-23825

An effective estimation and control algorithm of a class of nonlinear stochastic systems is developed. The systems considered are lump parameter which can be described by ordinary differential or difference equations. The systems are forced by stochastic processes such as process noises and measurement errors. Three recursive estimation algorithms have been developed here by the maximum likelihood approach, one for the algebraic model, one for the continuous model and one for the discrete model. For an algebraic model, a new sequential estimator is developed. For a dynamical system modelled by nonlinear differential equations and nonlinear measurements, a third order-likelihood filter is derived. It is compared with three nonlinear second-order filters, namely, the extended Kalman filter, the second-order likelihood filter and the stochastic linearization second-order filter due to Sunahara. Dissert. Abstr.

N77-14802 Texas Technological Univ., Lubbock.
DESIGN OF STOCHASTIC LINEAR CONTROL SYSTEMS ACCORDING TO CUMULANT BASED PERFORMANCE CRITERIA Ph.D. Thesis
Ronald Craig Hartwig 1976 58 p
Avail: Univ. Microfilms Order No. 76-23886

A set of performance statistics known as cumulants show the way to new design criteria for stochastic linear control systems. The new criteria allow the designer to affect the probability distribution of performance measures which do away with the need for stochastic simulation. Controllers arising in this new format are linear dynamical and exhibit the classical separation property. A class of controllers which is sub-optimal with respect to the new criteria is developed. Controller performance within this class is compared to controller performance resulting from the new design criteria. Dissert. Abstr.

N77-14803 Ohio State Univ., Columbus.
A QUASI-EXPERIMENTAL STUDY OF PERSONAL STYLE OF PROBABILITY ASSESSMENT Ph.D. Thesis
Robert Maurice Berg 1976 135 p
Avail: Univ. Microfilms Order No. 76-24558

The willingness and ability of decision makers to consider and express uncertainty about possible future events were investigated. Multivariate ordinal analyses are used to describe second-order partial associations between ordinal measures of personal probabilistic style, level of general education, level of probability and statistics education, and risk averseness. Dissert. Abstr.

N77-14804# Technische Hogeschool, Delft (Netherlands). Dept. of Mechanical Engineering.
THE DERIVATION OF THE ONSAGER CASIMIR RECIPROCITY RELATIONS WITHOUT USING BOLTZMANN'S POSTULATE
G. D. C. Kuiken Oct. 1976 20 p refs
(WTHD-92) Avail: NTIS HC A02/MF A01

Boltzmann's postulate that the entropy of a system is proportional to the logarithm of the probability of the corresponding state has no rational foundation, although it gives satisfactory results for systems in thermal equilibrium. For nonequilibrium thermodynamics such unfounded statements should not be used for purposes of justification of its foundations. It is shown how this postulate can be avoided by solving the appropriate Fokker-Planck equation for the probability. Some further restrictions to the OCRR are indicated. It is shown that the probability of a state is determined by the entropy production, from which the nonnegative character of the entropy production follows. Author

N77-14805# Florida State Univ., Tallahassee. Dept. of Statistics.
THE ROLE OF THE POISSON DISTRIBUTION IN APPROXIMATING SYSTEM RELIABILITY OF k-OUT-OF-n STRUCTURES
R. J. Serfling Dec. 1975 22 p refs
(Contract N00014-75-C-0551)
(AD-A026314; FSU-Statistics-M365; TR-101-ONR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The determination of the exact reliability of a complex system of components (or subsystems) is typically a formidable theoretical and computational problem. Often one resorts merely to bounds on system reliability. The present paper delineates, for k-out-of-n structures, a simple and easily implemented approach based on the Poisson distribution. The components are allowed to be statistically dependent and to have unequal reliabilities. Special attention is given to the cases of independent and Markov dependent components, and some numerical illustration is provided. Comparisons are made to other reliability bounds in the literature. Reliability bounds for k-out-of-n structures have wide application, including series systems, parallel systems, monitoring systems, and systems with spares. The results are also applicable in the context of availability. Author (GRA)

N77-14806# Stanford Univ., Calif. Dept. of Statistics.
ON A SPECTRAL ESTIMATE OBTAINED BY AN AUTOREGRESSIVE MODEL FITTING
Mituaki Huzii Feb. 1976 43 p refs
(Contract N00014-75-C-0442; NR Proj. 042-034)
(AD-A025721; SU-TR-22) Avail: NTIS HC A03/MF A01 CSCL 12/1

A stationary Gaussian process x(T) is considered which is expressed as an autoregressive process of infinite order. An autoregressive model of finite order K is fitted for this process and an estimate for the spectral density is obtained. The consistency and the asymptotic normality of this estimate under some conditions are shown. This estimate has an asymptotically efficient property in a sense under some conditions which are stronger than Berk's conditions. GRA

N77-14807# Stanford Univ., Calif. Dept. of Operations Research.
COMPUTING WAITING TIMES IN GI/E SUB k/c QUEUEING SYSTEMS
David Avis Feb. 1976 42 p refs
(Contract N00014-76-C-0418; Grant NSF GK-35491; NR Proj. 047-061)
(AD-A025730; SU-TR-62) Avail: NTIS HC A03/MF A01 CSCL 12/2

A computational procedure is developed that enables the computation of the stationary waiting time distribution of a GI/E sub k/c queueing system, from the stationary distribution of the state of the system. The study forms a sequel to some recent results for computing the latter distribution. Computational results are reported for several GI/E sub 2/2 systems. These results lead to a conjecture concerning the stochastic ordering of waiting time distributions under variation of the input process distribution. GRA

N77-14808# Stanford Univ., Calif. Dept. of Operations Research.
SOME STOCHASTIC BOUNDS FOR DAMS AND QUEUES
J. Michael Harrison Feb. 1976 25 p refs
(Contract N00014-76-C-0418; Grant NSF GR-35491; NR Proj. 047-061)
(AD-A025729; SU-TR-61) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is the purpose of this paper to derive bounds for U and V. These are of interest primarily because of the role played by U in the theories of storage, queueing and collective risk. (In each case the literature emphasizes models where Z is compound Poisson, but the generalization to infinite jump rates causes little difficulty and is pleasing from a theoretical standpoint.) In storage theory, one interprets Z as the input process to a storage system (or dam) and c as the rate at which material is released from the sytem when its content is positive. In collective risk theory, one interprets Z as the cumulative claims against an insurance company and c as the rate at which premium payments are received from policy holders. GRA

N77-14809# Stanford Univ., Calif. Dept of Statistics.
CRAMER-VON MISES TYPE STATISTICS FOR THE GOODNESS-OF-FIT OF CENSORED DATA: SIMPLE HYPOTHESIS
A. N. Pettitt and M. A. Stephens 5 Jan. 1976 69 p refs
(Contract N00014-67-A-0112-0085; NR Proj. 042-267)
(AD-A025732; SU-TR-229) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper considers modifications of Cramer-von Mises type goodness-of-fit statistics based on the sample distribution function when observations are censored. The asymptotic distributions of the modified statistics, the Cramer-von Mises statistic W sub n squared, the Anderson-Darling statistic A sub n squared and the Watson statistic U sub n squared, are found to be sums of weighted chi-squared random variables, where the weights are eigenvalues of integral equations. The small sample distribution of the modified W sub n squared statistics are approximated by three-moment fits. Also the asymptotic power of the statistics is considered for shifts of location for the normal population, and shifts of scale for the normal and exponential populations. The modified statistics can also be partitioned into components as Durbin and Knott showed the standard statistics could be. These components are considered and their asymptotic relative efficiencies given for the same cases as the asymptotic power for complete statistics above. Finally the use of the statistics is illustrated with some hypothetical data. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

No abstracts in this category.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N77-14810# Loughborough Univ. of Technology (England). Dept. of Mathematics.
ATTAINABLE SETS FOR CERTAIN CONTROL SYSTEMS, PART 1
J. Kyle Dec. 1975 17 p refs
(MATHS-Res-85) Avail: NTIS HC $3.50

Theorems are developed and exemplified for control theory based on a Hausdorff topological space (control space). ESA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N77-14811 Polish Academy of Sciences, Warsaw.
THE FOUNDATIONS OF THE ELECTRODYNAMICS OF NON-LINEAR CONTINUA
G. A. Maugin (Paris Univ.) 26 Jan. 1976 132 p refs
Avail: Issuing Activity

The principles of virtual power in its generalized form and Coleman's thermodynamics and / or the Onsager theory of irreversible processes are used to develop the dynamic (through not relativistic) theory of electromagnetic continua with interactions. Special cases described include: nonlinear elastic ferromagnets, including the phenomena of spin relaxation for both strong and weak dampings; elastic dielectrics with polarization gradients and inertia; classical paramagnetic polarized nonlinear elastic solids; nonlinear M.H.D. and electrohydrodynamics; ferrofluids; elastic dielectrics with quadrapoles; elastic ferrites and antiferromagnets; elastic ferromagnets with gradients of strain; and liquid crystals in magnetic fields. The range of applicability of each equation obtained is specified, and compared with previous works. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N77-14812 Stanford Univ., Calif.
EFFECTS OF FRICTION AND HEAT CONDUCTION ON SOUND PROPAGATION IN DUCTS Ph.D. Thesis
Patrick Huerre 1976 161 p
Avail: Univ. Microfilms Order No. 76-26018

The first part is devoted to an alternative mathematical formulation of the problem, whereby the fluctuating velocity field is considered as the superposition of acoustic (related to pressure), thermal (related to entropy), and viscous (related to vorticity) parts. Such a decomposition reduces the linearized Navier-Stokes equations to a system of three linear partial differential equations for three basic unknown functions: an acoustic scalar potential, a thermal scalar potential, and a viscous vector potential. This methodology is then applied to a study of small amplitude fluctuating motions in a two dimensional duct of constant width with rigid and isothermal walls. The governing equations are non-dimensionalized in terms of five nondimensional parameters which are functions of the duct width, the frequency of the perturbation and the characteristic properties of the fluid. Dissert. Abstr.

DATA SUMMARY: Data Summary not prepared due to nonavailability of complete document for processing.

N77-14813 Cincinnati Univ., Ohio.
THEORY AND MEASUREMENT OF ACOUSTIC WAVE PROPAGATION IN MULTI-SEGMENTED RECTANGULAR FLOW DUCTS Ph.D. Thesis
Robert Eugene Kraft 1976 271 p
Avail: Univ. Microfilms Order No. 76-25127

Analytical and experimental techniques are developed which examine the finer details of the propagation processes, and the unification of these techniques into a verified method of treatment design which optimizes the suppression of noise under a given set of constraints. A series of analytical parameteric studies are conducted using the prediction program, examining such topics as the design of two-element liners for peak suppression at discrete frequencies, the sensitivity of peak suppression to modal content, the effects of flow, frequency, and treatment length on optimum suppression, and the comparison of single-mode design criteria to suppression in finite length ducts. The so called multi-phasing effects of multi-element liners are examined in detail. Suppression bandwidth characteristics of optimized single-degree-of-freedom-type treatment designs are predicted. Dissert. Abstr.

DATA SUMMARY: Data Summary not prepared due to nonavailability of complete document for processing.

N77-14814# Boeing Computer Services, Inc., Seattle, Wash.
AIRCRAFT CONFIGURATION NOISE REDUCTION. VOLUME 1: ENGINEERING ANALYSIS Final Report, Aug. 1974 - Jun. 1976
D. G. Dunn, L. M. Butzel, A. DiBlasi, L. Filler, and L. D. Jacobs Jun. 1976 411 p refs
(Contract DOT-FA74WA-3497)
(AD-A030655/5; D6-42849-1; FAA-RD-76-76-Vol-1) Avail: NTIS HC A18/MF A01 CSCL 20/1

Use of wing and fuselage structures as noise barriers for shielding aircraft engine noise from the community is discussed. Favorable aircraft configurations for community noise reduction of turbojet and turbofan powered aircraft are used. Significant noise reduction potential is illustrated on a hypothetical engine-over-wing (EOW) configuration using high bypass ratio, turbofan engines. Noise shielding estimation procedures are developed for two types of configuration noise reduction concepts; i.e., the EOW and the engine-over-fuselage. Results are described for a theoretical analysis, a major Boeing/Aeritalia test program, and an empirical analysis of test data. As a result, analytical prediction procedures are defined, computerized, and added to software. The shielding prediction procedures consider individual noise components: inlet fan, compressor, exit fan, core, turbine, and jet noise. A new source, jet/edge interaction noise, can also be predicted using the procedures. The collective software, incorporating the shielding package, can be used to estimate community noise levels of wing and fuselage shielded turbofan or turbojet noise. Author

DATA SUMMARY: Diverse data are presented; variables are frequencies in Hertz, attenuation, directivity angle, noise reduction, sound pressure level, scattering angle, polar microphone angle, polar angle, shadow angle, time, shielding and unshielding.

N77-14815# Boeing Commercial Airplane Co., Seattle, Wash.
AIRCRAFT CONFIGURATION NOISE REDUCTION. VOLUME 2: COMPUTER PROGRAM USER'S GUIDE AND OTHER APPENDICES Final Report, Aug. 1974 - Jun. 1976
D. G. Dunn, D. J. Cecil, L. M. Butzel, J. M. Campbell, H. U. Lu, C. N. Berman, and L. Filler Jun. 1976 135 p
(Contract DOT-FA74WA-3497)
(AD-A030656/3; D6-42849-2; FAA-RD-76-76-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 20/1
For abstract, see N77-14814.

DATA SUMMARY: Estimation of installation effects on the radiated far field flyover noise; variables are noise diffraction, angles, octave band, frequencies, sound pressure, sideline distance, and sound attenuation; 13 figures and 16 tables include numerical data.

N77-14816# Boeing Commercial Airplane Co., Seattle, Wash.
AIRCRAFT CONFIGURATION NOISE REDUCTION. VOLUME 3: COMPUTER PROGRAM SOURCE LISTING Final Report, Aug. 1974 - Jun. 1976
D. G. Dunn and D. J. Cecil Jun. 1976 295 p 3 Vol.
(Contract DOT-FA74WA-3497)
(AD-A030657/1; D6-42849-3; FAA-RD-76-76-Vol-3) Avail: NTIS HC A13/MF A01 CSCL 20/1
For abstract, see N77-14814.

DATA SUMMARY: No numeric data are presented.

N77-14817*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NOISE RESPONSE OF CAVITIES OF VARYING DIMENSIONS AT SUBSONIC SPEEDS
Patricia J. W. Block Washington Dec. 1976 36 p refs
(NASA-TN-D-8351; L-11045) Avail: NTIS HC A03/MF A01 CSCL 20A

An expression for the Strouhal number of lengthwise cavity oscillations is obtained which includes the effect of length-to-depth ratio. This expression, which agrees well with the experimental

data, is also used to predict the Mach number at which cavity acoustic response is maximum. Interaction between lengthwise and depthwise modes is seen to occur at Mach numbers from 0.1 to 0.5. Cavity shape is shown to affect the noise spectra in generating either a broadband or narrowband signal. Author

DATA SUMMARY: Effect of cavity shape on noise spectra; variables include acoustic power level, frequency, noise radiation, Mach number, sound amplitude, Strouhal number, oscillation frequencies; 8 figures and 2 tables include numeric data.

N77-14818# Westinghouse Electric Corp., Annapolis, Md. Oceanic Div.

NONLINEAR SCALING LAWS FOR PARAMETRIC RECEIVING ARRAYS. PART 1: THEORETICAL ANALYSIS

F. H. Fenlon (Pennsylvania State Univ., State College) and J. W. Kesner 30 Jun. 1976 48 p refs

(Contract N00039-75-C-0259; ARPA Order 2910)

(AD-A027577) Avail: NTIS HC A03/MF A01 CSCL 20/1

Following a review of the literature on Parametric Receiving Arrays, the problem of defining their performance characteristics under saturated and unsaturated conditions is considered. Basically, the problem is resolved by establishing equations for the axial field of a spatially symmetric pump wave in the spectral domain via Kuznetsov's nonlinear paraxial wave equation. As a biproduct of this analysis, a simplification of terms involving the phase of pump wave in these equations results, upon transformation to the time domain, in a new form of Burgers' equation for a plane piston projector. Unlike previous forms of Burgers' equation, the latter combines the effect of wave interactions in the near and far field regions of the source. Numerical comparisons of the more complete spectral equations and the spectral form of the new Burgers' equation are shown to be in good agreement with experimental results previously reported in the literature. Approximate solutions of these equations are also derived. The three methods thus established for representing the pump field are then used to derive scaling laws for parametric receiving arrays, which clearly show the limiting effect of pump wave saturation upon the conversion efficiency of the up-conversion process as the pump amplitude is increased indefinitely. Author (GRA)

DATA SUMMARY: Axial pressure field of radiated signals in 3 inch projector; variables are peak sound pressure level, peak source level, psi, extra dB loss, maximum finite amplitude absorption loss, angle degrees; 6 figures include numeric data.

N77-14819# Westinghouse Electric Corp., Annapolis, Md. Oceanic Div.

NONLINEAR SCALING LAWS FOR PARAMETRIC RECEIVING ARRAYS. PART 2: NUMERICAL ANALYSIS

J. W. Kesner and F. H. Fenlon (Pennsylvania State Univ., State College) 30 Jun. 1976 120 p ref

(Contract N00039-75-C-0259; ARPA Order 2910)

(AD-A027578) Avail: NTIS HC A06/MF A01 CSCL 20/1

This report outlines the procedures used in a computer program for calculating nonlinear scaling laws for parametric receiving arrays. The basic equations, the program input and output, the program listing, and sample computer runs are included. The program output is in the form of curves for harmonic amplitudes as a function of range, the extra dB loss as a function of range, and parametric receiving array beam patterns at given ranges. Both detailed analytical solutions and approximate solutions are available in the computer program. Author (GRA)

DATA SUMMARY: Diverse data are presented; variables are pressure, angle degrees, extra dB loss, psi.

N77-14820# United Technologies Research Center, East Hartford, Conn.

ELECTRONICALLY PROGRAMMABLE PSK SAW DEVICES Quarterly Progress Report, 7 Jul. - 6 Oct. 1975

4 Nov. 1975 20 p refs

(Contract N00014-75-C-0978)

(AD-A026941; UTRC/R75-922275-1; QPR-2) Avail: NTIS HC A02/MF A01 CSCL 20/1

This report describes the work conducted by United Technologies Research Center during the period from 7 July 1975 through 6 October 1975, on a research and development program entitled, Electronically Programmable PSK SAW Devices. Research under this program is directed toward the development of a state-of-the-art Surface Acoustic Wave (SAW) module for use in electronically programmable, long code PSK signal correlation and encoding. The program is based on the UTRC PSK Diode-Correlator, a unique SAW device that utilizes nonlinear mixing phenomena in a hybrid semiconductor delay line configuration. When fully developed in 64 and 128 tap modular form, the PSK Diode-Correlator module will provide advantages in maximum chip rate, minimum tap dissipation, and electronic flexibility. Work during this quarter has been directed toward the fabrication and testing of a programmable 64 tap PSK Diode-Correlator. This prototype design has incorporated several significant modifying improvements to previous diode correlator configurations in order to minimize device insertion loss and spurious signal level. The following report details the design improvements, operational characteristics and experimental encoding and correlation performance of the 64 tap prototype PSK module. Author (GRA)

DATA SUMMARY: Hybrid semiconductor delay line configuration using surface acoustic wave devices; variables are output, input, sequencing, phase modulation, waveforms; 6 figures include numeric data.

N77-14821# United Technologies Research Center, East Hartford, Conn.

ELECTRONICALLY PROGRAMMABLE PSK SAW DEVICES Progress Report, 7 Oct. 1975 - 6 Apr. 1976

4 May 1976 21 p refs

(Contract N00014-75-C-0978)

(AD-A026942; UTRC/R75-922275-2; PR-3) Avail: NTIS HC A02/MF A01 CSCL 20/1

This report describes the work conducted by United Technologies Research Center during the period from 7 October 1975 through 6 April 1976, on a research and development program entitled, 'Electronically Programmable PSK SAW Devices.' Research under this program is directed toward the development of a state-of-the-art Surface Acoustic Wave (SAW) module for use in electronically programmable, long code PSK signal correlation and encoding. The program is based on the UTRC PSK Diode-Correlator, a unique SAW device that utilizes nonlinear mixing phenomena in a hybrid semiconductor delay line configuration. When fully developed in 64 and 128 tap modular form, the PSK Diode-Correlator module will provide advantages in maximum chip rate, minimum tap dissipation, and electronic flexibility. Experimental work during this period has been directed toward final selection of the correlator interaction region tap design through diagnostic measurements on four candidate structures. Two 128 tap devices having the selected tap design are now in the final stages of fabrication. Broadband transducer matching circuits for the cascade delay channel have also been optimized and characterized. In addition, a cascade circuit analysis has been formulated on the computer to predict degradation of the correlation response caused by system or device errors. The following report details the progress achieved in the above areas. Author (GRA)

DATA SUMMARY: Decrease in tilted interaction region nonlinear output caused by wavefront distortion; variables are wavelengths, real ohms, imaginary ohms, frequencies, decibels; 3 figures and 1 table include numeric data.

N77-14105# Battelle Inst., Frankfurt am Main (West Germany).

HARDWARE DEVELOPMENT AND PERFORMANCE TESTING OF AN ACOUSTICAL POSITIONING DEVICE

E. G. Lierke *In* ESA Mater. Sci. in Space Sep. 1976 p 333-339 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N77-14066 05-12)

Avail: NTIS HC A22/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N77-14822 California Univ., Los Angeles.
OPTICAL ABSORPTION IN A NARROW HALF-FILLED HUBBARD BAND Ph.D. Thesis
Jean-Pierre Gallinar 1976 142 p
Avail: Univ. Microfilms Order No. 76-25196

The line shape of the optical absorption spectrum in a half-filled Hubbard band is calculated to the lowest order in t/U. The problem is formulated in terms of the number of random walks of an electron and a hole which leave the spin configuration unchanged. We obtain a two particle Green's function from which both the absolute T=0 K antiferromagnetic (AF) ground state as well as a random (R) spin configuration are studied in one dimension. It is shown that at the frequency U/h the spectrum always exhibits a logarithmic singularity away from the absolute ground state. Extrapolation of the results indicates an insulator to metal transition at the critical value 4t/U=1. For the AF case, the generalization to higher dimensions is approximately done by summing all diagrams with no closed loops. Dissert. Abstr.

N77-14823 Texas Univ., Austin.
THE EFFECTIVE POLARIZABILITIES OF ATOMS ADSORBED ON METAL SURFACES Ph.D. Thesis
William Charles Meixner 1976 147 p
Avail: Univ. Microfilms Order No. 76-26673

The response of the metal surface to a point charge is computed, yielding binding energies, equilibrium distances and dipole moments. The sensitivity of these results to variations in the substrate density and in the relative strength of the inhomogeneity term of the kinetic energy is tested. The image plane and quantities which depend on it are sensitive to both the substrate density and the inhomogeneity term.Dissert. Abstr.

N77-14824 Dartmouth Coll., Hanover, N.H.
NUCLEAR SPIN INTERACTIONS IN DILUTE SOLID MIXTURES OF He-3 AND He-4 Ph.D. Thesis
Lawrence Allan Moberly 1976 193 p
Avail: Univ. Microfilms Order No. 76-25034

Thermodynamic properties of the solid which have a functional dependence on exchange are discussed. The two measured properties which have to date provided the best interpreted results are the magnetic susceptibility and the magnetic pressure (referred to as the exchange pressure). Previous measurements of both are reviewed in detail and as well the discrepancies which make further experiments of importance. Since this work was performed on samples containing small amounts of He-3 the effects of He-4 impurities are also discussed. Dissert. Abstr.

N77-14825*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ABSOLUTE RATE OF THE REACTION OF Cl(P-2) WITH MOLECULAR HYDROGEN FROM 200 - 500 K
David A. Whytock, Jai H. Lee, Joe V. Michael, Walter A. Payne, and Louis J. Stief Dec. 1976 21 p refs Submitted for publication
(NASA-TM-X-71248; X-691-76-281) Avail: NTIS HC A02/MF A01 CSCL 20H

Rate constants for the reaction of atomic chlorine with hydrogen are measured from 200 - 500 K using the flash photolysis-resonance fluorescence technique. The results are compared with previous work and are discussed with particular reference to the equilibrium constant for the reaction and to relative rate data for chlorine atom reactions. Theoretical calculations, using the BEBO method with tunneling, give excellent agreement with experiment. Author

N77-14826*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRUM OF DOUBLY IONIZED YTTRIUM (Y3) Final Report
Gabriel L Epstein and Joseph Reader (NBS, Washington, D.C.) 31 Oct. 1974 6 p refs Repr. from J. of the Optical Soc. of Am., vol. 65, no. 3, Mar. 1975 p 310-314
(NASA-TM-X-74271; PB-256912/7) Avail: NTIS HC A02/MF A01 CSCL 07D

The spectrum of doubly ionized yttrium was observed from 600 to 9700 A by means of plane- and concave-grating spectrographs. About 100 new lines were observed. From these measurements, 40 new energy levels were derived. The known level system (Rb 1 isoelectronic sequence, 4p6nl) now includes the series ns(n=5-9), np(n=5-9), nd(n=4-8), nf(n=4-10), ng(n=5-8), and nh(n=6-8). The nf series shows irregular fine structure splittings, 4f having negative splitting of about 3/cm. The ionization energy of Y3 was determined. GRA

N77-14827# General Electric Co., St. Petersburg, Fla. Dept. of Neutron Devices.
ANALYSIS OF HYDROGEN ISOTOPES IN THIN FILMS
T. K. Mehrhoff and J. O. Humphries 16 Apr. 1976 26 p refs
(Contract E(29-2)-656)
(GEPP-215) Avail: NTIS HC A03/MF A01

Mass spectrometer modifications made for high resolution analysis of hydrogen isotopes outgassed from occluder thin films are described. The electronic modifications made to the source, magnet power supply, and scanning circuits provided increased precision in the mass range 2 to 6. Routine analyses were made at a resolution of 1300 with a Faraday cup detector. Extensive modification of the inlet system provided capability for outgassing of thin occluder films. Accuracy and precision evaluations were presented for gaseous and thin film samples. ERA

N77-14828# Princeton Univ., N.J. Plasma Physics Lab.
ON THE NONLINEAR CLASSICAL THEORY OF INDUCED COMPTON SCATTERING BY RELATIVISTIC CHARGES
Shayne Johnston and Russell M. Kulsrud May 1976 42 p refs
(Contracts F44620-75-C-0037; W-7405-eng-48; AF Proj. 9751)
(AD-A027702; PPL-AP-87; AFOSR-76-0736TR) Avail: NTIS HC A03/MF A01 CSCL 20/8

Attention is focused on the resonant interaction between a single charge, treated relativistically, and two coherent electromagnetic waves. The simplicity of context is exploited to elucidate aspects of the nonlinear theory of induced Compton scattering. In this paper I, a well-defined problem of finite duration is studied, namely the induced scattering of plane radiation pulses of arbitrary shape. The factors which affect the net wave conversion from one pulse to the other by a nearly resonant charge are investigated analytically. Author (GRA)

N77-14829# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
A SHOCK TUBE STUDY OF THE REACTION OF H ATOMS WITH DF Interim Report
Jerry F. Bott 28 May 1976 27 p refs
(Contract F04701-75-C-0076)
(AD-A026285; TR-0076(6603)-8; SAMSO-TR-76-116) Avail: NTIS HC A03/MF A01 CSCL 07/4

The reaction rate of H with DF has been measured at temperatures between 2100 and 3900 K in a shock tube study. The measurements indicate that the sum of the two reaction rates for H + DF yields HD + F and H + DF yield D + HF has an activation energy of 33,700 cal/mol-sec. These data establish upper limits for each of the rate coefficients and should serve as a guide for theoretical calculations. Author (GRA)

N77-14830# Massachusetts Inst. of Tech., Cambridge.
REVIEW OF MOLECULAR BEAM RESEARCH IN THE MIT AERONAUTICS AND ASTRONAUTICS DEPARTMENT, 1970-1975 Final Report, 1 Apr. 1973 - 31 Mar. 1976
Leon Trilling and Harold Y. Wachman Jun. 1976 33 p refs
(Contract DAHC04-73-C-0013)
(AD-A026771; ARO-10897.2-GS) Avail: NTIS HC A03/MF A01 CSCL 07/4

In the course of the research program into phenomena related to gas-surface interaction which the authors conducted over the last several years, the broad objective has been to seek answers to the following general question: Given a stream of gas molecules of known properties approaching a specified surface, how does

one predict the velocity and flux distributions of the streams which leave the surface. Beginning with very simple configurations, they have attempted to account for an increasingly detailed extended set of properties of the solid surface, of the gas stream and of the interaction process. They have attempted to formulate the basic problem with a view to understanding molecular transport phenomena, first on inert metallic surfaces such as the skins of satellite vehicles in orbital flight, and later on ice crystals and nucleating centers in Brownian motion in the upper atmosphere. They have also begun to study the mechanism of interaction of molecular and atomic oxygen on graphite surfaces. GRA

N77-14831# Rome Air Development Center, Griffiss AFB, N.Y.
ELECTRON MULTIPLE SCATTER BETWEEN PLANE-PARALLEL SLABS
A. R. Fredrickson and A. D. Morris Griffiss AFB, N. Y. RADC May 1976 27 p refs
(AF Proj. 5621)
(AD-A026114; RADC-TR-76-137) Avail: NTIS HC A03/MF A01 CSCL 20/8

Electrons between 0.4 and 1.4 MeV are experimentally introduced in various directions between two parallel metal plates. The electrons multiply scatter between the two plates. We measure the fraction absorption on each plate. Data are tabulated for nearly all permutations of electron incidence angles (0, 15, 30, 45 and 60 deg. from the surface normal) and plate combinations (Al, Cu, Sn and Pb). Accurate data for single plate electron albedos are also tabulated. Author (GRA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N77-14832# Ktech Corp., Albuquerque, N.Mex.
CARBON RIBBON GAUGE FOR ELECTRON BEAM DIAGNOSTICS
D. V. Keller, D. A. Rice, and E. D. Stretanski Kirtland AFB, N. Mex. AFWL May 1976 102 p refs
(Contract F29601-75-C-0084)
(AD-A026905; Ktech-TR-75-19; AFWL-TR-75-284) Avail: NTIS HC A06/MF A01 CSCL 20/8

Large carbon and graphite monofilaments have been investigated for applications as an in-line diagnostic for pulsed electron beam irradiations of materials. The energy absorbed by the carbon ribbon causes a change in resistance which is measured a few microseconds after energy deposition. The measurement is therefore completed before there are any thermal losses or before the ribbon is broken by debris (from either specimen or anode materials). Both laboratory resistance and pulsed electron beam heating tests were made on carbon and graphitized carbon ribbon, and on Poco graphite rods. The first two materials survived doses up to 2000 cal/g; their resistance decreased with energy and they are suitable as a beam diagnostic up to 800 cal/g specific energy, above which their resistance change was insensitive to energy deposition. The Poco graphite resistance decreases by about 40% at doses of 200-400 cal/g, then increases at about 2-3% per 100 cal/g. This material would be a suitable beam monitor for doses from 400 cal/g to 1200 cal/g, and probably to 1700 cal/g and above. Additional work is required relating resistance change for these materials to absorbed ribbon dose, and determination of the maximum dose for which the Poco graphite can be used. Author (GRA)

N77-14833# Intelcom Rad Tech, San Diego, Calif.
GAMMA-RAY PRODUCTION CROSS SECTIONS FOR SILICON AND COPPER FROM THRESHOLD TO 20 MeV Final Report, 1 Jan. 1973 - 31 May 1976
V. C. Rogers, D. Costello, D. R. Dixon, C. C. Hoot, and V. J. Orphan 2 Oct. 1975 39 p refs
(Contract DNA001-74-C-0041; DNA Proj. NWED-GAXPC101)
(AD-A026702; INTEL-RT-8099-006; DNA-318F) Avail: NTIS HC A03/MF A01 CSCL 20/8

Gamma-ray production cross sections for neutron interactions in natural silicon and copper have been measured for neutron energies between 0.67 and 20.2 MeV, and for gamma-ray energies between 365 keV and 10.246 MeV. The cross sections are in general agreement with previous work for both discrete peaks and unfolded spectra. Author (GRA)

N77-14834# National Bureau of Standards, Washington, D.C. Center for Radiation Research.
DIRECT COMPARISONS OF THE NBS ABSORBED DOSE CALORIMETERS IRRADIATED WITH 20 AND 50 MeV ELECTRONS Final Report
S. R. Domen, P. J. Lamperti, and T. Mikado (Industrial Sci. and Technol. Agency) Jul. 1976 23 p refs
(PB-256191/8; NBSIR-76-1023) Avail: NTIS HC A02/MF A01 CSCL 18D

Two NBS absorbed dose calorimeters were compared in 20 and 50 MeV electron beams that were scattered with lead foils of various thicknesses. The internal structures of the calorimeters are identical. The non-portable model is enclosed in a 40 cm x 40 cm x 30 cm thick graphite medium while a 30 cm diameter x 15 cm thick graphite medium was used to enclose the portable model. Measured results indicate that the three internal bodies of the calorimeters and their measuring circuits were constructed with sufficient care to produce essentially identical calorimetric responses to about 0.1%. GRA

N77-14835# Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics.
VACUUM ARC NEUTRON GENERATOR Final Report
B. S. Fraenkel, J. L. Schwob, D. Shaltiel, and D. Froindlich Kirtland AFB, N. Mex. AFWL May 1976 20 p
(Grant AF-AFOSR-2562-73)
(AD-A027199; AFWL-TR-75-264) Avail: NTIS HC A02/MF A01 CSCL 20/9

Giant vacuum sparks have been useful for obtaining highly ionized atoms and high temperatures. It has been attempted to introduce deuterium into the electrode material, in order to obtain fusion in the spark. Generally, however, the hot plasma point formed in vacuum sparks did not form here. The presence of deuterium seems to prevent evolution of the processes leading to high temperatures. In some cases, however, several thousand neutrons were observed on sparking. GRA

N77-14836# Cornell Univ., Ithaca, N.Y.
A PRELIMINARY STUDY OF A HYBRID FUSION REACTOR AT MODERATE TEMPERATURE
Richard L. Liboff 21 Jul. 1976 17 p refs
(Contract N00014-76-C-0030; NR Proj. 021-311)
(AD-A027196; R7-76) Avail: NTIS HC A02/MF A01 CSCL 18/5

A hybrid fission-fusion system is investigated which operates in a moderate temperature range. The fuel is LiD which is a solid at room temperature. The fusion reaction is maintained by a neutron source from a fission reactor. For a spherically concentric system with interface radius equal to 5m, and a fission neutron flux of 10 to the 13th power/sq cm sec, the output power due to fusion is estimated to be 10 kw. The direct heating of the lattice owing to Li6 neutron capture for these same dimensions is estimated to be 23 Mw and it is concluded that the system is inefficient as a fusion device. Author (GRA)

74 OPTICS

Includes light phenomena.

N77-14837 Polish Academy of Sciences, Warsaw.
USE OF GEOMETRICAL OPTICS IN CERTAIN DISPERSIVE MEDIA [ZASTOSOWANIE OPTYKI GEOMETRYCZNEJ W PEWNYCH OSRODKACH DYSPERSYJNYCH]
Nadiezda Bobrowa 19 Dec. 1975 16 p refs In POLISH
Avail: Issuing Activity

The use of geometrical optics to study dispersive media has aroused considerable interest recently. A great deal of attention is being devoted to spatial dispersion. A generalized dependence of electric induction on field intensity in an isotropic medium

is presented. The solution of Maxwell equations by geometrical optics is presented. Conclusions contain unprocessable data.
Author

DATA SUMMARY: No numeric data are presented.

N77-14838 British Library Lending Div., Boston Spa (England).
TECHNICAL AND TECHNOLOGICAL PRINCIPLES OF STEREO-70
N. A. Ovsyannikova Jun. 1976 24 p Transl. into ENGLISH from tekhnika kino i televideniya (Moscow), v. 3, 1975 p 1626
(BLL-RTS-10116) Avail: British Library Lending Div., Boston Spa, Engl.: £10.00; 13 BLL overseas or 39 UK BLL photocopy coupons

Double-lens filming and projection, and practical methods for producing three dimensional films are discussed. The installation of a lenticular raster screen (without spectacles) or an aluminum screen (with spectacles) is an essential requirement for the separation of the pictures. The specific requirements of the stereo cinema bring modifications in the filming process using a special video-format equipment. I.M.

DATA SUMMARY: No numeric data are presented.

N77-14839 British Library Lending Div., Boston Spa (England).
ON A METHOD FOR CALCULATING LOW-VOLTAGE FILAMENT LAMPS
V. I. Limanov and V. S. Litvinov Jun. 1976 7 p refs Transl. into ENGLISH from Svetotekhina (Moscow), v. 11, 1975 p 4-5
(BLL-RTS-10200) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 7 BLL overseas coupons or 21 UK BLL photocopy coupons

A method is proposed for the design of low-voltage lamps. The geometric parameters of the filamentary body are determined with regard to the influence of the cooling action of the current leads and support wires on the distribution of the filamentary body physical parameters by length and on the parameters of the lamp as a whole. Author

DATA SUMMARY: No numeric data are presented.

N77-14840 British Library Lending Div., Boston Spa (England).
METAL HALIDE GAS-DISCHARGE LAMPS ABROAD (REVIEW)
I. A. Kulakov Jun. 1976 14 p Transl. into ENGLISH from Svetotekhnika (Moscow), v. 11, 1975 p 21-27
(BLL-RTS-10199) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 7 BLL overseas or 21 UK BLL photocopy coupons

Various metal halide lamp designs are compared. Factors discussed include: rated power, light-radiating additives, bulb shape, luminophore coating, and arc position. The present state-of-art and areas of development are also reviewed. J.M.S.

DATA SUMMARY: Comparison of metal halide lamps according to producer; variables are sources of light, light output, total color rendition index, color temperature, arc position, useful life, radiating additions, bulb parameters, electric criteria; 2 tables include numeric data.

N77-14841 Utah State Univ., Logan.
A SPECULAR CHAMBER FOR OFF-AXIS RESPONSE EVALUATIONS OF HIGH-REJECTION OPTICAL BAFFLING SYSTEMS Ph.D. Thesis
John Cooley Kemp 1976 116 p
Avail: Univ. Microfilms Order No. 76-25614

A special chamber for measuring the off-axis response of high-rejection optical baffling systems was designed and constructed. The ambient background power level caused by atmospheric scattering was reduced by using high-efficiency particulate filters to remove the atmospheric aerosols and produce a clean-room environment. The effects of surface scattering were reduced by using specular surfaces in a modified cylindrical shape to direct the scattered radiation away from the baffle entrance. Two computer programs were used to predict the magnitudes of the atmospheric and surface scattering. Dissert. Abstr.

DATA SUMMARY: Data summary not prepared due to non-availability of complete document for processing.

N77-14842*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SYSTEM FOR THE MEASUREMENT OF ULTRA-LOW STRAY LIGHT LEVELS Patent Application
Charles L. Wyman, inventor (to NASA), Donald B. Griner, Charles A. Hawkins, Gary H. Hunt (Sperry Rand Corp., Huntsville, Ala.), William A. Hurd (Sperry Rand Corp., Huntsville, Ala.), Glen B. Shelton (Sperry Rand Corp., Huntsville, Ala.), Bill B. Fannin (Arizona Univ., Tucson), and Robert P. Breault (Arizona Univ., Tucson) Filed 29 Dec. 1976 22 p
(NASA-Case-MFS-23513-1; US-Patent-Appl-SN-755323) Avail: NTIS HC A02/MF A01 CSCL 20F

An apparatus for measuring the effectiveness of stray light suppression light shields and baffle arrangements used in optical space experiments is described. The light shield and baffle arrangement and a telescope model are contained in a vacuum chamber. A source of short, high powered light energy illuminates portions of the light shield and baffle arrangement and reflects the light to a photomultiplier tube by virtue of multipath scattering. NASA

DATA SUMMARY: No numeric data are presented.

N77-14843*# Itek Corp., Lexington, Mass.
SPACE TELESCOPE OPTICAL TELESCOPE ASSEMBLY/ SCIENTIFIC INSTRUMENTS. PHASE B: PRELIMINARY DESIGN AND PROGRAM DEFINITION STUDY. VOLUME 2A. FOCAL PLANE CAMERA Final Report
1 Apr. 1976 117 p
(Contract NAS8-29949)
(NASA-CR-150117; ITEK8-29949-FR1-Vol-2A) Avail: NTIS HC A06/MF A01 CSCL 20F

Trade studies were conducted to ensure the overall feasibility of the focal plane camera in a radial module. The primary variable in the trade studies was the location of the pickoff mirror, on axis versus off-axis. Two alternatives were: (1) the standard (electromagnetic focus) SECO submodule, and (2) the MOD 15 permanent magnet focus SECO submodule. The technical areas of concern were the packaging affected parameters of thermal dissipation, focal plane obscuration, and image quality. Author

DATA SUMMARY: Encircled energy and point spread functions of the focal plane camera at 325 nm; variables are relative intensity, image diameter, modulation transfer, cycles, time, index of refraction, wavelengths, cooling capacity, temperature differential; 23 figures include numeric data.

N77-14844*# Itek Corp., Lexington, Mass. Optical Systems Div.
SPACE TELESCOPE OPTICAL TELESCOPE ASSEMBLY/ SCIENTIFIC INSTRUMENTS. PHASE B: PRELIMINARY DESIGN AND PROGRAM DEFINITION STUDY; VOLUME 2A: PLANETARY CAMERA REPORT Final Report
1 Apr. 1976 48 p Prepared in cooperation with Bendix Aerospace Systems Div., Mishawaka, Ind. Martin Marietta, Denver, Colo. and Lockheed Missiles and Space Co., Inc., Sunnyvale, Calif.
(Contract NAS8-29949)
(NASA-CR-150118; ITEK8-29949-FR2-Vol-2A) Avail: NTIS HC A03/MF A01 CSCL 20F

Development of the F/48, F/96 Planetary Camera for the Large Space Telescope is discussed. Instrument characteristics, optical design, and CCD camera submodule thermal design are considered along with structural subsystem and thermal control subsystem. Weight, electrical subsystem, and support equipment requirements are also included. J.M.S.

DATA SUMMARY: Thermal and structural analyses of the F/48, F/96 Planetary Camera; variables include cooling capacity per CCD cooler, temperature difference across cooler, alignment tolerances, sensitivity of optical base bench to thermal gradients, image motion due to changes in heat flow, body pointing errors

after operation of camera mechanisms, vibrational disturbances, power dissipated, time, estimated weight; 4 figures and 7 tables include numeric data.

N77-14845*# Itek Corp., Lexington, Mass.
SPACE TELESCOPE OPTICAL TELESCOPE ASSEMBLY/ SCIENTIFIC INSTRUMENTS. PHASE B: PRELIMINARY DESIGN AND PROGRAM DEFINITION STUDY. VOLUME 2A(3): ASTROMETRY Final Report
1 Apr. 1976 76 p
(Contract NAS8-29949)
(NASA-CR-150119; ITEK8-29949-FR3-Vol-2A) Avail: NTIS HC A05/MF A01 CSCL 20F

Wide field measurements, namely, measurements of relative angular separations between stars over a relatively wide field for parallax and proper motion determinations, were made with the third fine guidance sensor. Narrow field measurements, i.e., double star measurements, are accomplished primarily with the area photometer or faint object camera at f/96. The wavelength range required can be met by the fine guidance sensor which has a spectral coverage from 3000 to 7500 A. The field of view of the fine guidance sensor also exceeds that required for the wide field astrometric instrument. Requirements require a filter wheel for the wide field astrometer, and so one was incorporated into the design of the fine guidance sensor.
Author

DATA SUMMARY: Star availability in 3.7 sq mrad field of a fine guidance sensor; variables are time, displacement from image center, visual magnitude, relative intensity, average number of stars, angular separation between stars, image width, wavelengths, relative power, noise equivalent angle; 24 figures include numeric data.

N77-14846# California Univ., Livermore. Lawrence Livermore Lab.
SIMULATION OF OPTICAL SYSTEMS
L. G. Yaffe, V. A. Mode, D. H. Sisson, and G. G. McMillan 11 Mar. 1976 5 p refs Presented at Summer Computer Conf., Washington, D. C., 12 Jun. 1976 Revised Sponsored by ERDA
(UCRL-77512-Rev-1; Conf-760703-1) Avail: NTIS HC A02/MF A01

A computer code to evaluate quantitatively the macroscopic behavior of photons in a broad range of optical systems, especially luminescence spectrometers, is briefly described. The user has full flexibility to define the elements and optical characteristics of the system and to use a source having nonlinear characteristics.
ERA

DATA SUMMARY: Front surface viewing for source to glass, glass to air, air to mirror, mirror to slit, and slit to detector; variables include fraction of light and optical density; 1 figure includes numeric data.

N77-14847# Air Force Academy, Colo.
LABORATORY TEST OF THE ASCOT ELECTRO-OPTICAL TRACKER AIDED BY A DIGITAL ESTIMATOR Final Report, 15 Apr. - 30 Jun. 1975
Anthony L. Leatham, Edward J. Bauman, Ronald P. Fuchs, and Charles E. Fosha Apr. 1976 113 p refs
(AD-A026849; USAFA-TR-76-7) Avail: NTIS HC A06/MF A01 CSCL 19/5

A digital six state estimator was developed to aid the Bendix ASCOT (Adaptive Scan Optical Tracker) in the presence of background clutter. Laboratory tests were conducted at the US Air Force Academy Guidance and Control Laboratory to determine the basic accuracy of the ASCOT in a laboratory environment. During the tests the ASCOT tracker was successfully aided through various kinds of background clutter by two different methods. The first method was to aid the ASCOT in the presence of background clutter using an independent sensor. In the laboratory, this independent sensor signal consisted of the true target position corrupted by radar-type noise. The second method was to drive the ASCOT with the digital estimator during the presence of background clutter.
Author (GRA)

DATA SUMMARY: Ascot and radar parameters are compared; variables are position, velocity, acceleration, interrupt, lighting, time of flight, azimuth/elevation during breaklock, azimuth/ elevation deflection coil voltage; 29 figures include numeric data.

N77-14848# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
THE NATIONAL MEASUREMENT SYSTEM FOR OPTICS Final Report
Dennis A. Swyt Mar. 1976 63 p
(PB-256644/6; NBSIR-75-942) Avail: NTIS HC A04/MF A01 CSCL 20F

A proposed model for the National Measurement System for Optics is discussed, including the role of standards committees, instrument manufacturers and measurement users. The economic dimensions of the measurements impact areas and the technological base from which new measurement technology springs are described.
GRA

DATA SUMMARY: Optical properties and market utilization of optical equipment; variables include modulation transfer function, resolution, spatial frequency, costs, light sensitivity; 2 figures and 13 tables include numeric data.

N77-14849# Washington Univ., Seattle. Dept. of Electrical Engineering.
GEOMETRIC DISTORTIONS IN A COHERENT OPTICAL PROCESSOR
Robert E. Francois, Jr. and F. Paul Carlson Apr. 1976 70 p refs
(Contract N00014-76-C-0230; NR Proj. 350-005)
(AD-A026124; UW-TR-194) Avail: NTIS HC A04/MF A01 CSCL 20/6

This report is concerned with the theory of implementing geometric distortions using a single planar element in a coherent optical system. Necessary and sufficient conditions for a distortion to be realizable are developed, and the optical transfer function appropriate to any realizable distortion is given in terms of the distortion functions. Bandlimiting phenomena are inherent to this technique, and a technique for estimating this bandlimiting is discussed. The application of geometric distortions to the synthesis of space-variant integral transform is also discussed.
Author (GRA)

DATA SUMMARY: No numeric data are presented.

N77-14850# Naval Electronics Lab. Center, San Diego, Calif.
UNDERWATER RADIANCE SCANNER
R. D. Anderson 1 Jun. 1976 54 p refs
(XF21222702)
(AD-A026893; NELC-TD-477) Avail: NTIS HC A04/MF A01 CSCL 20/6

The Underwater Radiance Scanner was developed to measure radiance distributions of natural light fields underwater. It was deployed in a series of experiments designed to validate a model describing propagation of optical energy from a satellite to an underwater terminal. In addition to measuring radiance distribution, the instrument is required to rapidly sample the solar energy distributions found just below the surface at an adequate rate to define the sea surface wave slope statistics. A Radiance Camera system was designed around the Nikkor fisheye lens, which has a nominal field of 180 degrees. Since an entire hemisphere is projected onto a photographic film in the focal plane of the fisheye lens, it became practicable for the first time to acquire data of high resolution rapidly. Two such cameras were mounted together, one covering the upper hemisphere, the other the lower, to obtain complete radiance distributions. The usual problems of using film to make photometric measurements are encountered in the radiance camera. It is necessary to take two frames at differing exposure values to accommodate the dynamic range of the scene. Data reduction is accomplished after careful film processing using an automatic scanning microdensitometer coupled to a computer.
GRA

DATA SUMMARY: Linear, empirical, and second degree polynomial types of solar deflection sensitivity; variables are zenith angle, deflection radius, gain factors, digital output, angstroms, radiometric response, spectral radiance, transmission, data bits; 19 figures include numeric data.

N77-14851# Rockwell International Corp., Anaheim, Calif. Electronics Group.
OPTICAL WAVEGUIDE LENSES, 1 Final Technical Report, 15 Nov. 1974 - 15 Nov. 1975
D. B. Anderson, R. L. Davis, J. T. Boyd, R. R. August, and R. E. Eisele May 1976 184 p refs
(Contract F33615-75-C-1017; AF Proj. 2001)
(AD-A027214; C74-1187.13/501; AFAL-TR-76-54) Avail: NTIS HC A09/MF A01 CSCL 20/6

The results of an effort to develop thin-film waveguide optical elements for implementation of the Fourier transform may be employed for a real-time RF spectral analyzer is delineated herein. Various types of simple refractors and reflectors for folding are considered in conjunction with a beam expansion telescope and a telephoto lens system. Author (GRA)

DATA SUMMARY: Eleven near infrared waveguide substrates are characterized; variables include effective refractive index, normalized lens radius, lens thickness, spatial interval focus, temporal frequency resolution, normalized film thickness, waveguide thickness, waveguide scatter loss, effective focal length, and angular blur width; 24 figures and 17 tables include numeric data.

N77-14852# Rome Air Development Center, Griffiss AFB, N.Y.
AN OPTOACOUSTIC TECHNIQUE FOR MEASURING THE OPTICAL ABSORPTION COEFFICIENT IN SOLIDS Final Report
A. Hordvik, H. Schlossberg, H. Miller, and C. Gallagher Mar. 1976 16 p refs
(AF Proj. 5634)
(AD-A027632; RADC-TR-76-70) Avail: NTIS HC A02/MF A01 CSCL 20/6

An investigation was made of an optoacoustic technique for determining the optical absorption coefficients in solids. A train of laser pulses was passed through the solid, and the amplitude of the acoustic wave generated by the absorbed radiation was measured by a piezoelectric transducer attached directly to the sample. It was shown theoretically and experimentally that the output voltage from the transducer was proportional to the absorbed energy. The generated voltage per unit of absorbed energy was established by measuring the output voltage at a laser wavelength of known absorption coefficient. This value was then used as a reference to determine the absorption coefficient at other laser wavelengths. Author (GRA)

DATA SUMMARY: Optoacoustic investigations of solids; variables include acoustical signal output, laser input power, chipping frequency, distance, absorption coefficient, wavelength; 4 figures and 1 table include numeric data.

N77-14853# Stanford Univ., Calif.
RESEARCH STUDIES ON TUNABLE OPTICAL PARAMETRIC OSCILLATORS Interim Technical Report, 1 Oct. 1974 - 30 Sep. 1975
S. E. Harris and J. F. Young Jun. 1976 22 p refs
(Contract F19628-75-C-0046; AF Proj. 5634)
(AD-A027667; SU-GL-2534; RADC-TR-76-181) Avail: NTIS HC A02/MF A01 CSCL 20/6

The primary goal of this contract is research studies of tunable optical sources, and the development of coherent sources in new spectral regions. In particular, a major project this year has been IR image up-conversion based on three frequency summing in metal vapors. A general theory of the efficiency of these up-converters as a function of the pump laser spectrum, detuning, and linewidth, and of the linewidth of the selected non-allowed atomic transition has been developed. Author (GRA)

DATA SUMMARY: Pressure broadening in frequency converters; variables include gas pressure, atomic linewidth; 2 figures include numeric data.

N77-14854# Polhemus Navigation Sciences, Inc., Burlington, Vt.
AN ADVANCED HELMET MOUNTED SIGHT (AHMS) SYSTEM Final Report, Nov. 1971 - Apr. 1973
Jun. 1976 120 p refs
(Contract F33615-72-C-1482)
(AD-A026620; PNSI-TR-72-0966; AMRL-TR-73-47) Avail: NTIS HC A06/MF A01 CSCL 19/5

The report describes a fully-operable breadboard model of a unique AHMS (Advanced Helmet Mounted Sight) system which uses a controlled magnetic field to establish the position-sensing coupling between the helmet-mounted sight and the airframe. The system uses a single, passive, helmet-mounted sensor and one or more fixed radiators (depending on the particular application) in conjunction with a System Electronics Unit to implement a closed-loop transducing and computing scheme which provides a full six-degrees-of-freedom for head position sensing. The system is accurate, simple (in a mechanical sense), rugged, reliable, and easy to maintain. GRA

DATA SUMMARY: Performance of breadboard and dimensions of motion box; variables include error (degrees), length; 1 figure and 2 tables include numeric data.

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N77-14855 Polish Academy of Sciences, Warsaw.
AN INVERSE ELECTROMAGNETIC PROBLEM OF A HETEROGENEOUS ANISOTROPIC PLASMA [ELEKTROMAGNETYCZNY PROBLEM ODWROTNY DIAGNOSTYKI NIEJEDNORODNEJ ANIZOTROPOWEJ PLAZMY]
A. Brahmer-Kacprzynska and W. Zielke 19 Dec. 1975 20 p refs In POLISH
Avail: Issuing Activity

A solution for an inverse problem of a temporal spatial system of hyperbolic equations of first order describing electromagnetic wave propagation in a heterogeneous anisotropic plasma is presented. Coefficients of the set of first order hyperbolic equations which are directly connected to the parameters of the medium are sought under the assumption that those coefficients are solely dependent on the spatial variable. The characteristics of the set under study are straight lines and are in agreement with the characteristics of wave equations. I.M.

N77-14856 Polish Academy of Sciences, Warsaw.
AN ANALYSIS OF WEAK DISCONTINUITIES IN SOLUTIONS OF QUASI-LINEAR HYPERBOLIC SYSTEMS WITH APPLICATION TO MAGNETOGASODYNAMICS [ANALIZA SLABYCH NIECIAGLOSCI W ROZWIAZANIAGH UKLADOW HIPERBOLICZNYCH QUASI-LINIOWYCH W ZASTOSOWANIU DO ROWNAN MAGNETOGAZODYNAMIKI]
Wlodzimierz Laprus 19 Dec. 1975 77 p refs In POLISH
Avail: Issuing Activity

Systems of partial equations of the first order which are quasilinear, hyperbolic, and with two independent variables are examined. The existence is established of a solution which is continuous in a certain range D of a plane x,t and differentiable in the subranges D1 and D2 created by division of the range D by a curve C. On the curve C, derivative (normal) solutions can experience jump discontinuities. Using data obtained from this solution, weak discontinuities in solutions of magnetogasodynamic equations with finite and infinite conductivity are analyzed. The general structure of an asymptotic expansion in the environment of particular characteristics is given with an exactness of up to terms of the second order in relation to the parameters designating distance from the characteristic. Author

N77-14857 Polish Academy of Sciences, Warsaw.
THE GENERALIZED LANGEVIN EQUATION, AUTOCORRELATIONS, AND PLASMA RESISTIVITY [UOGOLNIONE ROWNANIE LANGEVINA AUTOKORELACJE I REZYSTYWNOSC PLAZMY]
Krzysztof Zuchowski 19 Dec. 1975 13 p refs In POLISH
Avail: Issuing Activity

Langevin's equation is generalized and treated as a phenomenologically stochastic equation to describe Brownian movements. The differences between the usual and the generalized equations and the motivation for using the latter to describe phenomena in plasma are reviewed. The correctness of fluctuational-dissipational theorems obtained for plasma is investigated utilizing known values of autocorrelation of the electric field and determining therefrom the resistivity of the plasma. Author

N77-14858 Dartmouth Coll., Hanover, N.H.
BREMSSTRAHLUNG EMISSION COEFFICIENT OF A PLASMA IN A UNIFORM MAGNETIC FIELD Ph.D. Thesis
Robert John Pangborn 1976 170 p
Avail: Univ. Microfilms Order No. 76-24967

The leading (electron-ion, dipole) contribution to the bremsstrahlung spectrum of a Maxwellian plasma in a constant, uniform magnetic field is calculated. The plasma is assumed infinite and fully ionized. A simpler, more direct derivation of Kirchoff's law for anisotropic media is presented. The plasma dispersion relation is then found using previously obtained expressions for the conductivity tensor (accurate to first order in collisional effects). From the dispersion the collisional damping, assumed small, is obtained and by means of Kirchoff's law an expression for the bremsstrahlung emission coefficient is written. Dissert. Abstr.

N77-14859 Illinois Univ., Urbana-Champaign.
CALCULATIONS OF THE ELECTRON ENERGY DISTRIBUTION FUNCTION IN A URANIUM PLASMA BY ANALYTIC AND MONTE CARLO TECHNIQUES Ph.D. Thesis
Charles Gary Bathke 1976 120 p
Avail: Univ. Microfilms Order No. 76-24039

Electron energy distribution functions have been calculated in a U-235 plasma at 1 atmosphere for various plasma temperatures (5,000-8,000 K) and neutron fluxes. The distributions are assumed to be a summation of a high-energy tail and a Maxwellian distribution. The sources of energetic electrons considered are the fission-fragment induced ionization of uranium and the electron induced ionization of uranium. The calculation of the high-energy tail is reduced to an electron slowing down calculation, from the most energetic source (approximately 2.1 keV) to the energy where the electron is assumed to be incorporated into the Maxwellian distribution (approximately 15 eV). The pertinent collisional processes are electron-electron scattering and electron induced ionization and excitation of uranium. Dissert. Abstr.

N77-14860# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ELECTRON-FLUX LIMITATION DUE TO ION ACOUSTIC INSTABILITY
T. Yabe and K. Niu Jun. 1976 10 p refs
(IPPJ-254) Avail: NTIS HC A02/MF A01

Laser energy absorbed in an irradiated pellet is converted to high energy parts of the electron distribution. The contribution of these electrons to the transport phenomena is investigated. The flux limited theory is discussed. Another theory is presented which limits electron thermal conduction due to ion acoustic instability. Two dimensional PIC methods are used to simulate the flux limitation. Initial calculations are given. Thermal flux in simulations is shown to approach the theoretical value when the phenomena approaches the steady state. Author

N77-14861# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THE ROLES OF TURBULENCE ON PLASMA HEATING
Takaichi Kawamura and Takaya Kawabe Jun. 1976 25 p refs
Presented at 3d Intern. Meeting on Theoretical and Experimental Aspects of Heating of Toroidal Plasmas, Grenoble, France, 28 Jun. - 2 Jul. 1976
(IPPJ-255) Avail: NTIS HC A02/MF A01

The characteristic features of turbulent heating and the effects of turbulence on plasma heating are discussed from several points of view. The relation between the heating rate of plasma particles and the thermalization (randomization) frequency is summarized. The role of plasma turbulence in fast thermalization is discussed as being applicable not only in high current turbulent heating, but also in heating by turbulence due to the other means, for example, high power RF waves. The relation between the development of turbulence and particle heating, and the effect of scattering of particles by the turbulent waves are investigated. The influence of turbulence on the diffusion across the confinement magnetic field is considered. Author

N77-14862# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DISSIPATIVE STRUCTURE AND LIMIT CYCLE OF NONLINEAR UNSTABLE COLLISIONAL DRIFT MODE
T. Hatori and Y. Terashima Jun. 1976 12 p refs
(IPPJ-250) Avail: NTIS HC A02/MF A01

Based upon the model equations of quasilinear type, the nonlinear behavior of the collisional drift instability is studied from a point of view of dissipative structure. It is shown that near marginal stability, the drift mode is saturated to a nonlinearly stable state. As the ion viscosity decreases, bifurcation of nonlinear steady state occurs and no stable steady state is possible. The limit cycle appears instead of stationary solution. Particle transport is also estimated. Author

N77-14863# Nagoya Univ. (Japan). Inst. of Plasma Physics.
STOCHASTIC ACCELERATION BY AN ELECTROSTATIC WAVE NEAR ION CYCLOTRON HARMONICS
Atsushi Fukuyama, Hiromu Momota, and Ryohei Itatani Sep. 1976 22 p refs
(IPPJ-259) Avail: NTIS HC A02/MF A01

A nonlinear effect of a large amplitude electrostatic wave propagating perpendicularly to a static magnetic field on the motion of an ion is studied. The case where the frequency of the wave w is sufficiently close to a multiple of the ion cyclotron frequency is considered. It is found that the trapping motion is influenced by periodic forces. These forces lead to randomization of the trapping motion near the separatrix, and ions are expected to be stochastically accelerated. In order to confirm the results, numerical calculations are carried out. Author

N77-14864# Lockheed Missiles and Space Co., Palo Alto, Calif.
COMPUTATION OF THE GAS MOTION BEHIND A LIGHT DETONATION WAVE FRONT TAKING INTO ACCOUNT LATERAL BROADENING OF THE PLASMA COLUMN
A. F. Goncharenko, I. V. Nemchinov, and V. M. Khazins 1976 11 p refs Transl. into ENGLISH from Prikl. Mekhan. i Tekhn. Fiz. (USSR), no. 3, 1976 p 18-28
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Nonstationary gasdynamic processes in a plasma column (hot column), which is formed behind a shock front moving towards a laser beam are considered. A quasi-one-dimensional approximation is used; the parameters in the channel are considered degenerate over the section but dependent on the time and distance along the axis. The motion in the cold, compact shell surrounding the channel is considered one dimensional, cylindrically symmetric. Solutions of the appropriate partial differential equation systems permit approximate determination of the parameters in both the case when the radiation path is small compared to the beam radius (light detonation), and when the path is commensurate with the radius. Examples are presented of the appropriate numerical computations. It is shown that a regime of incomplete absorption can be realized in the latter case, when only the part of the radiation energy incident on the front is liberated behind the shock front moving at constant velocity to the Jouget plane. Author

N77-14865# Princeton Univ., N.J. Plasma Physics Lab.
COALESCENCE INSTABILITY OF MAGNETIC ISLANDS
J. M. Finn and P. K. Kaw Mar. 1976 26 p refs
(Contracts E(11-1)-3073; F44620-75-C-0037)
(MATT-1220) Avail: NTIS HC A03/MF A01

The stability of a periodic magnetic island structure was studied using the ideal MHD equations. An instability was found which described the tendency toward coalescence of parallel currents in the neighboring islands. This instability will proceed at a fast MHD rate as long as the forces driving the instability can overcome the stabilizing forces due to the compression of the magnetic field between the islands. Beyond that phase, resistivity was expected to dominate the tendency toward island coalescence. Island coalescence of this kind can explain why in the observation of tearing mode instabilities in tokamaks, only the modes with minimum values of m and n are seen. ERA

N77-14866# Los Alamos Scientific Lab., N.Mex.
HYDRODYNAMIC STABILITY OF A DENSE PLASMA IN A CORRUGATED MAGNETIC FIELD
M. D. Spektor 1975 22 p refs Transl. into ENGLISH from Zh. Prikl. Mekh. Tekh. Fiz. (USSR), no. 1, 1975 p 30-40
Sponsored by ERDA
(LA-TR-75-38) Avail: NTIS HC A02/MF A01

The hydrodynamic stability of a plasma in a corrugated magnetic field was considered. The criterion of stability of fluted perturbations, which holds true for an arbitrary beta = 8pi p/B2,

was obtained. In a sufficiently long system there always exist unstable fluted perturbations with a wavelength far exceeding the period of corrugation. For such most dangerous perturbations the equations of movement were solved and the growth rates of instability were found in the case of an ideal plasma, taking into account the viscosity. ERA

N77-14867# Los Alamos Scientific Lab., N.Mex.
CALCULATED POWER OUTPUT FROM A THIN IRON-SEEDED PLASMA
A. L. Merts, Robert D. Cowan, and N. H. Magee, Jr. Feb. 1976 48 p refs
(Contract W-7405-eng-36)
(LA-6220-ms) Avail: NTIS HC A03/MF A01

Ionization equilibrium calculations were carried out for iron ions at a density of 10 to the 12th power cm to the minus 3rd power in a hydrogen plasma with electron density 10 to the 14th power cm to the minus 3rd power, at temperatures from 0.8 to 10 keV. The computed radiated power loss from this plasma due to the iron ions ranged from about 4 W/cm to the 3rd power at the lowest temperature to about 0.4 W/cm to the 3rd power at the highest temperature; loss rates for other electron and ion densities will scale approximately as N/sub e/N/sub Fe/10 to the 26th power. The losses were due principally to collisionally excited line radiation at low temperatures and to collisionally excited delta n not equal to 0 transitions and to continuum radiative recombinations at high temperatures. Spectra were also computed for diagnostic X-ray K/sub delta/ (1s to 2p) transitions; the change in spectral distribution as a function of temperature agreed well with observations in the ST Tokamak. Bound-bound radiative transitions and dielectronic recombination were discussed at length in the appendices. ERA

N77-14868# Princeton Univ., N.J. Plasma Physics Lab.
TWO PLASMON PARAMETRIC DECAY IN A SLIGHTLY INHOMOGENEOUS PLASMA
J. J. Schuss and T. K. Chu Mar. 1976 15 p refs Presented to the 17th Annual Meeting of the Plasma Physics Div. of the Am. Physical Soc., St. Petersburg, Fla., 10-14 Nov. 1975 Sponsored in part by NSF
(Contract E(11-1)-3703)
(MATT-1207; Conf-751130-32) Avail: NTIS HC A02/MF A01

The convective parametric decay of an incident electromagnetic wave (omega 0,K 0) into two plasmons at omega = omega/sub p/ in a slightly inhomogeneous plasma of scale length L was considered. Asymptotic solutions for the fields were obtained which show that for L/lambda 0 much greater than (omega/sub p/lambda/sub D//v lambda 0) to the 2nd power, where v is the plasmon damping rate, the homogeneous-plasma decay criterion must be satisfied by the pump field for instability. ERA

N77-14869# Los Alamos Scientific Lab., N.Mex.
HIGH-FREQUENCY HEATING OF AN INHOMOGENEOUS PLASMA, 2
A. V. Longinov and K. N. Stepanov Feb. 1976 44 p refs Transl. into ENGLISH of Russian report KhFTI-72-2 Sponsored by ERDA
(LA-TR-76-7; KhETI-72-2) Avail: NTIS HC A03/MF A01

The heating of plasma by electromagnetic waves with frequencies of the order of, or smaller than ion cyclotron frequency is considered. The propagation of waves with frequencies omega sub Bi in an inhomogeneous plasma are examined. The possibilities of heating a plasma with a resonance 2 omega sub Bi and with ion cyclotron waves is studied. The possibilities of using MHD waves and magnetic pumping for heating a plasma of large dimensions are analyzed. Some problems of high-frequency heating, requiring further investigation, are considered. Numerical calculations of the parameters of various high-frequency methods of heating a plasma in traps of the type of a proposed toroidal thermonuclear reactor are given in tables. Author

N77-14870# California Univ., Irvine. Dept. of Physics.
PLASMA HEATING WITH A ROTATING RELATIVISTIC ELECTRON BEAM. 2: MAGNETOSONIC WAVE EMISSION
Kim Molfig and Norman Rostoker 1976 38 p refs Prepared in cooperation with Mass. Inst. of Technol., Cambridge
(Contract AT(04-3)-34)
(TID-27013) Avail: NTIS HC A03/MF A01

The magnetosonic wave emission by an intense relativistic electron beam rotating within a plasma is calculated. This process follows the beam trapping as determined earlier, and results in a transfer of approximately half the beam energy to the plasma ions. A nonlinear theory is given in accord with beam and plasma parameters of fusion interest. It is shown that dissipation balances the nonlinearity to produce a shock-type flow resembling that of the linear theory. ERA

N77-14871# California Univ., Livermore. Lawrence Livermore Lab.
REPETITIVELY PULSED CAPACITOR BANK FOR THE DENSE-PLASMA FOCUS
O. Zucker, W. Bostick, R. Gullickson, J. Long, J. Luce, and H. Sahlin Dec. 1975 16 p refs Presented to the 6th IEEE Symp. on Engineering Problems of Fusion Research, San Diego, Calif., 18-21 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77562; Conf-751125-141) Avail: NTIS HC A02/MF A01

A 1 pulse per second capacitor bank designed to energize a dense-plasma focus is described. The average power consumption, which has become a major issue due to the energy crisis, is analyzed with respect to other plasma devices and is shown to be highly favorable. This small source size high flux neutron source could be extemely useful to qualify fission reactor material irradiation results for fusion reactor design. ERA

N77-14872# Naval Research Lab., Washington, D.C.
RESULTS FROM THE TRITON ELECTRON BEAM-PLASMA INTERACTION EXPERIMENT
D. A. Hammer, K. A. Gerber, and W. F. Dove May 1976 28 p refs
(RR0110941; NRL Proj. H02-28B)
(AD-A025316; NRL-MR-3258) Avail: NTIS HC A02/MF A01 CSCL 20/9

Contents: Single Airport Activity Statistics; Average Airport Activity Statistics; Average Daily Operations; Frequency Distribution Histograms; and Annual Distribution of Airport Activity. GRA

N77-14873# Systems Science and Software, La Jolla, Calif.
THEORETICAL STUDIES OF SGEMP FIELD GENERATION Final Report, Nov. 1973 - Nov. 1974
Andrew Wilson Dec. 1974 130 p refs
(Contract DNA001-74-C-0043; DNA Proj. NWED-QAXEB089)
(AD-A026334; SSS-R-75-2469; DNA-3654F) Avail: NTIS HC A07/MF A01 CSCL 20/9

Analytic models of the generation of IEMP in cavities (at pressures below 1 torr) and external to conducting objects in free space are developed. A series of computer codes devised to extend the analytic approach to more complex situations is presented. Four areas of research are identified: (1) the effect of small conducting or dielectric objects on the potential distribution in a cavity in which space charge exists; (2) the development of an analytic method to treat space-charge dynamics before the onset of space-charge-limiting of a nonmonoenergetic current beam; (3) the formation and time-dependent behavior of a plasma sheath outside a (planar, cylindrical or spherical) conductor; and (4) the conditions for pinching to occur in a finite cavity. Numerical examples of each of the four topics are presented. Finally, the dynamics of a heavily space-charge-limited current in the SPI beam injection facility are examined with the electrostatic particle code. GRA

N77-14874# Princeton Univ., N.J. Plasma Physics Lab.
ANOMALOUS TRANSPORT DUE TO LONG-LIVED FLUCTUATIONS IN PLASMA. PART 1: A GENERAL FORMALISM FOR TWO-TIME FLUCTUATIONS
John A. Krommes and Carl Oberman Jan. 1976 73 p refs
(Contract F44620-75-C-0037; AF Proj. 9751)
(AD-A026356; PPL-AP-85-Pt-1; AFOSR-76-0696TR-Pt-1)
Avail: NTIS HC A04/MF A01 CSCL 20/9

A general formalism for describing two-time fluctuations in magnetized plasma is presented. GRA

N77-14875# Princeton Univ., N.J. Plasma Physics Lab.
ANOMALOUS TRANSPORT DUE TO LONG-LIVED FLUCTUATIONS IN PLASMA. PART 2: HYDRODYNAMIC CONTRIBUTIONS TO TRANSPORT IN TWO-DIMENSIONAL, STRONGLY MAGNETIZED SYSTEMS
John A. Krommes and Carl Oberman Jan. 1976 70 p refs
(Contract F44620-75-C-0037; AF Proj. 9751)
(AD-A026357; PPL-AP-86-Pt-2; AFOSR-76-0697TR) Avail: NTIS HC A04/MF A01 CSCL 20/9
For abstract, see N77-14874.

N77-14876# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ELECTROSTATIC ION CONFINEMENT IN A MAGNETIC MIRROR FIELD
Y. Nishida (Utsunomiya Univ., Japan), S. Kawamata (Utsunomiya Univ., Japan), and K. Ishii Aug. 1976 20 p refs
(IPPJ-256) Avail: NTIS HC A02/MF A01
The electrostatic ion stoppering at the mirror point is demonstrated experimentally in a magnetic mirror field. The ion losses from the mirror throat are decreased to about 15% of the initial losses in a rather high plasma density. It is discussed as a confinement mechanism of ions that particles are reflected back adiabatically at the throat of the magnetic mirror field supplemented by dc electric field. Author

N77-14877# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ION BEAM - PLASMA INTERACTION AT RIGHT ANGLES TO THE EXTERNAL MAGNETIC FIELD
Y. Kiwamoto (Yokohama Natl. Univ., Japan), M. Inutake, and Y. Kita Aug. 1976 34 p refs
(IPPJ-257) Avail: NTIS HC A03/MF A01
Lower hybrid wave instability caused by the interaction between a plasma and an ion beam perpendicular to an external magnetic field is studied both theoretically and experimentally. A homogeneous magnetized plasma with large volume and an ion beam source with large cross section [20 cm x 100 cm] have been constructed for this purpose. Observations of the wave propagation and the relaxation of the ion beam distribution are reported. The effect of the magnetic field which deforms the distribution into a stable form is discussed. Author

N77-14878# Nagoya Univ. (Japan). Inst. of Plasma Physics.
OBSERVATION OF ELECTROSTATIC ENVELOPE SOLITONS IN A PLASMA
Tadao Honsawa (Utsunomiya Univ., Japan) Sep. 1976 18 p refs
(IPPJ-258) Avail: NTIS HC A02/MF A01
Electrostatic envelope solitons excited in a plasma are described. Pump frequency adopted was comparable with the ion plasma frequency. Envelope solitions were observed to be formed in a group. The number of solitons per group was found to have a countable value up to 16 under a suitable condition. The number of solitons was also observed to be strongly dependent on such parameters as the pump and modulation frequencies, the amplitude of the applied RF voltage, and plasma parameters. Author

N77-14879# Harry Diamond Labs., Adelphi, Md.
FORMATION OF A NONUNIFORM CONDUCTING REGION NEAR AN AIR-SOLID BOUNDARY DURING IRRADIATION BY A PULSE OF HIGH ENERGY ELECTRONS
Herschel Weil and William T. Wyatt, Jr. Jan. 1976 25 p refs
(DNA Proj. NWED-QAXEB088; HDL Proj. X755E3)
(AD-A026016; HDL-TR-1735) Avail: NTIS HC A02/MF A01 CSCL 20/9
Equations are presented to describe the formation of the nonuniform plasma that will be generated on the air side of an air-solid interface by secondary electrons, due to a time-varying flux of Compton electrons. For tractability of the equations, a one-dimensional geometry is used. The equations are then a set of coupled nonlinear hyperbolic partial differential equations for the densities and velocities of the secondary electrons and ions and the electric field, in terms of two independent variables: time and perpendicular distance from the interface. An interactive numerical procedure is outlined for stepwise simultaneous determination of both the characteristics (which depend on the solutions because of the nonlinearity) and the solutions to the equations. GRA

N77-14880# TRW Systems Group, Redondo Beach, Calif.
MAGNETIC FIELD ANNIHILATION OF IMPULSIVE CURRENT SHEETS Final Report
C. L. Dailey, H. A. Davis, and R. H. Lovberg 31 Mar. 1976 102 p refs
(Contract F44620-71-C-0031; AF Proj. 9752)
(AD-A026346; AFOSR-76-0698TR) Avail: NTIS HC A06/MF A01 CSCL 20/9
The acceleration mechanism has been studied experimentally in several plasma accelerators which have utilized the collision of a pair of oppositely moving current sheets to set up a plasma/field configuration in which magnetic field energy is converted to plasma energy by the annihilation of antiparallel magnetic fields. Two 40 cm diameter, planar, spiral coils were used to drive the plasma by an impulsive, inductive, discharge for the initial experiments. GRA

N77-14881# Fairchild Republic Co., Farmingdale, N.Y.
PLASMA ACCELERATION IN PULSED ABLATIVE ARC DISCHARGES Interim Report, 15 Mar. 1975 - 15 Mar. 1976
Dominic J. Palumbo and Martin Begun 15 Mar. 1976 53 p refs
(Contract F44620-74-C-0055; AF Proj. 9752)
(AD-A027725; AFOSR-76-0738TR) Avail: NTIS HC A04/MF A01 CSCL 20/9
This program was the second phase of an effort to describe and understand plasma acceleration processes in pulsed ablative plasma accelerators using a continuum MHD approach as the basis for analytic modeling. Concurrent with analytic modeling, an experimental diagnostic effort was also performed so that calculated results could be compared to the measured parameters for evaluation of the applicability and accuracy of the model. Diagnostic measurements performed included magnetic flux density using small coil probes, current distribution using a Rogowski coil, plasma front location and velocity using time of arrival probes, and high speed photography using a high speed framing camera. Data was recorded on a digital memory oscilloscope having appropriate frequency response. An unsteady two-dimensional model of the plasma motion including the dissipative effects of finite plasma conductivity, viscosity, and thermal conductance was postulated. The model included direct coupling of the external capacitor discharge circuit to the plasma via the time variant plasma resistance and inductance. A second order accurate two-step explicit numerical integration scheme was used to solve the resulting five simultaneous parabolic partial differential equations and a second order Runge-Kutta technique was simultaneously used to solve the two simultaneous second order ordinary differential equations for discharge current and potential. Results of the two dimensional diagnostic scan are presented in detail but the results of calculations are not included since various problems with the numerics did not enable performing sufficient analysis to verify or disprove the applicability of the proposed model. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.
For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N77-14882 Polish Academy of Sciences, Warsaw.
ACOUSTIC METHODS OF STUDYING THE STRUCTURE OF HETEROGENEOUS SOLIDS [AKUSTYCZNE METODY BADANIA STRUKTURY NIEJEDNORODNYCH CIAL STALYCH]
Jozef Lewandowski 23 Mar. 1976 22 p refs In POLISH
Avail: Issuing Activity
The problem of developing an acoustic method of determining concentration of heterogeneity in a solid and its influence on elastic porperties is discussed. Attempts to determine (on the basis of considerations of a static character) an interdependence between parameters characterizing heterogeneity of solid structure and its elastic properties and the phase velocity of an acoustic wave are described. A dependency between those same parameters and physical magnitudes is found on the basis

of considerations of a dynamic character, viewing the process of ultrasonic wave propagation in a heterogeneous solid with the process of its dissipation on heterogeneities. A formal analogy is used in the mathematical description of the process of propagating elastic waves in a solid and in a field which are treated as continuous mediums. Author

N77-14883 Brandeis Univ., Waltham, Mass.
ASPECTS OF THE ELECTRONIC STRUCTURE OF LIQUID METALS Ph.D. Thesis
Howard Kenneth Peterson 1976 125 p
Avail: Univ. Microfilms Order No. 76-25317

The energy spectrum of a one dimensional array of delta function potentials is studied as a function of the degree of short range order in the arrangement of the scatterers. The integrated density of states is evaluated numerically and the results used to compare alternate theoretical formalisms. A modification of the selected method is made to make it compatible with a three dimensional muffin-tin model Hamiltonian. The qualitative behavior of the quasiparticle spectrum of a realistic three dimensional transition or noble metal liquid is discussed. The electronic states in liquid copper are calculated within the framework of the muffin-tin model. Dissert. Abstr.

N77-14884 Nebraska Univ., Lincoln.
APPLICATION OF ELLIPSOMETRY TO UNIAXIAL CRYSTALS Ph.D. Thesis
Mervat Anwar El-Shazly Zaghloul 1976 104 p
Avail: Univ. Microfilms Order No. 76-25899

The complex ordinary and extraordinary refractive indices of an absorbing uniaxial crystal are explicitly derived from the normalized diagonal and off-diagonal elements of one oblique incidence reflection matrix measured by generalized elipsometry on a crystal face that contains the optic axis at an oblique orientation with respect to the plane of incidence. At most four solution sets are mathematically and physically consistent with one measurement set. In many cases, identification of the correct solution is feasible without additional measurements. Measurements of the ordinary and extraordinary refractive indices of a cadmium sulphide crystal at selected wavelengths by generalized elipsometry yield values that agree with published data.
Dissert. Abstr.

N77-14885 Delaware Univ., Newark.
DYNAMICS OF DOMAIN WALLS IN FERROMAGNETIC CONDUCTORS Ph.D. Thesis
Ji-Nong Sun 1976 209 p refs
Avail: Univ. Microfilms Order No. 76-24233

Eddy current losses in a ferromagnetic conductor were investigated from a theoretical point of view using a microscopic approach. The domain wall was considered to be finite in width and the eddy currents were calculated by taking into account the individual spin vector movements within the translating domain wall. The eddy current losses are expressed as a function of the ratios of the sheet thickness to the domain wall spacing and width. As the sample thickness approaches the domain wall width, eddy current loss terms are predicted. Separation of magnetic losses was achieved using minor B-H loop loss measurements and the Kerr effect observations. Below half saturation, the eddy current loss term dominated while above half saturation the nucleation-annihilation losses of the domain walls dominated. The quasi-static magnetization reversal process of a narrow strip was observed by using the Kerr effect.
Dissert. Abstr.

N77-14886 Stevens Inst. of Tech., Hoboken, N.J.
A TRACER STUDY OF ELECTROMIGRATION IN THIN Au FILMS Ph.D. Thesis
King Lien Tai 1976 109 p
Avail: Univ. Microfilms Order No. 76-25170

A new macroscopic model for grain boundary electromigration has been developed to describe simultaneous grain boundary diffusion and electromigration. This model was capable of explaining the major features of the experimental results. Among the significant findings of this research are the following: (1) grain boundary electromigration in Au is anode directed; (2) the effect of bulk diffusion on electromigration in grain boundaries was qualitatively demonstrated; and (3) the activation energy was found to be 0.80 + or - 0.03eV.
Dissert. Abstr.

N77-14887 Princeton Univ., N.J.
HIGH-FIELD EFFECTS IN SiO2 FILMS ON SILICON Ph.D. Thesis
Han-Sheng Lee 1976 111 p
Avail: Univ. Microfilms Order No. 76-25105

High-field charge injection, transport and trapping in silicon dioxide films thermally grown on silicon substrates were investigated. The method used to induce charge-carrier injection and transport was to charge the unmetallized surface with ions extracted from a corona discharge in a gas at atmospheric pressure. With positive corona the observed current through the oxide was independent of the gas used, indicating that the current was carried by electrons tunnel-injected into the oxide from the conduction band of the silicon substrate. With negative corona the observed current depends on the gas ambient, demonstrating that tunnel injection of electrons from the negatively charged front surface must be taking place. Dissert. Abstr.

N77-14888 Princeton Univ., N.J.
A STUDY OF THE EFFECTS OF LOW ENERGY ELECTRON IRRADIATION ON MOS CAPACITORS Ph.D. Thesis
Chin-Tay Shih 1976 117 p
Avail: Univ. Microfilms Order No. 76-23812

A preliminary study was made of the effect of electron beam penetration on charge storage in the oxide. The most complete results were obtained with oxides grown on n type substrates. An electron beam with energy in the nonpenetrating range produced negative charge storage, in correspondence with the results described above. Increase of the beam energy to the point of penetration to the silicon-oxide interface resulted in a net positive storage of charge. Reduction of the beam energy to nonpenetrating values restored the negative charge storage. It would appear that two effects are present: negative charge storage in bulk electron traps generated by the beam, and positive charge storage caused by electrons which penetrate to the silicon oxide interface. Dissert. Abstr.

N77-14889*# Scientific Translation Service, Santa Barbara, Calif.
STUDY OF CARBON BLACKS BY ELECTRON PARAMAGNETIC RESONANCE
A. Charlier, P. Taglang, J. B. Donnet, J. Lahaye, J. Metzger, and E. Papirer Washington NASA Dec. 1976 23 p refs Transl. into ENGLISH of Carbon (France), v. 3, 1965 p 231-240
(Contract NASw-2791)
(NASA-TT-F-17325) Avail: NTIS HC A02/MF A01 CSCL 20L

The spin resonance of H.A.F. and M.P.C. carbon blacks oxidized by ozone or Nitric acid was studied by means of a 9 kMc/sec. EPR spectrometer. The oxidation treatments create new paramagnetic centers in addition to those already present in the carbon blacks. Because the corresponding spin absorption X2 increases with oxidation time it is concluded that the oxidizer (O2, O3, or HNO3) is responsible for the creation of these new spin centers. The thermal variation of X2 obeys the Curie-Weiss law with a Curie temp. of 60 K, independent of oxidation time and of the type of oxidation process. Author

N77-14890*# Kanner (Leo) Associates, Redwood City, Calif.
VARIATION OF THE ELECTRON PARAMAGNETIC RESONANCE SIGNAL OF NEUTRON-IRRADIATED POLYCRYSTALLINE GRAPHITE WITH TEMPERATURE
M. Nechtschein and T. Kester Washington NASA Dec. 1976 8 p refs Transl. into ENGLISH from Variation Avec la Temperature du Signal de Resonance paramagnetique Electronique de Graphite Polycristallin Irradie par des Neutrons, Carbon, (France), v. 1, no. 2, 1964 p 143-145
(Contract NASw-2790)
(NASA-TT-F-17334) Avail: NTIS HC A02/MF A01 CSCL 20L

Electron spin resonance absorption of heavily neutron-irradiated polycrystalline graphite was studied, 1.25 to 293 K. The sample was irradiated by 3.9 x 10 to the 17th power fast neutrons/sq cm at 50 deg. The resonance signal obtained showed the asymmetric line shape predicted by Dyson's theory for the

resonance absorption in conductors (asymmetry parameter A/B = 2). To obtain the temperature dependence of the intensity of the signal, the resonance of graphite was compared with that of a MgO crystal containing a certain amount of Mn. The temperature depsndence for both lines was nearly identical (Curie law). Thus, by considering the Curie law and the value of the asymmetry parameter, the observed resonance seemed to be due to localized spin centers equally distributed in the sample.
Author

N77-14891*# Kanner (Leo) Associates, Redwood City, Calif.
PARAMAGNETIC ABSORPTION IN ANTHRACITES
Yu. N. Nedoshivin, N. V. Frolova, V. I. Kasatochkin, and V. Ya. Posyl'nyy Washington NASA Dec. 1976 5 p Transl. into ENGLISH from K voprosu o paramagnitnom pogloshchenii v antratsitakh, Khim. Tverdogo Topliva, (USSR), no. 1, 1973 p 141-143
(Contract NASw-2795)
(NASA-TT-F-17348) Avail: NTIS HC A02/MF A01 CSCL 20L

There are different types of paramagnetic centers in the anthracite samples containing 0 to 15% ash and having a particle size of 1 to 3 mm. Paramagnetic absorption signals obtained in a vacuum were not equivalent to those obtained after heating at 300 deg. Milling of the samples led to the change in the shapes of EPR signals and to the formation of new radicals. The unpaired electrons detected by EPR were pi-electrons.
Author

N77-14892*# Kanner (Leo) Associates, Redwood City, Calif.
ELECTRON PARAMAGNETIC RESONANCE (EPR) OF CARBON IN ANTHRACENE AND ACRIDINE
A. Marchand, P. Delhaes, and J. Zanchetta Washington NASA Dec. 1976 8 p refs Transl. into ENGLISH of J. Chim. Phys. (France), v. 60, no. 5, 1963 p 688-690
(Contract NASw-2790)
(NASA-TT-F-17350) Avail: NTIS HC A02/MF A01 CSCL 20L

The EPR signals for carbon from anthracene and acridine were identical from 600 to 1,100 deg. The thermal variation of paramagnetism in carbon treated above 900 deg indicated a certain delocalization of paramagnetic centers. Author

N77-14893# Siemens A.G., Erlangen (West Germany).
DEVELOPMENT OF HIGH FIELD SUPERCONDUCTORS Final Report, Sep. 1974
Alfred Mueller, Manfred Wilhelm, Guenther Ziegler, and Engelbert Springer Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1976 267 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-235)
(BMFT-FB-T-76-08) Avail: NTIS HC A12/MF A01; ZLDI, Munich DM 47,50

Superconducting intermetallic compounds with A-15 structure such as Nb3Al, Nb3(Al,Ge), Nb3Sn, and V3Ga show distinctly high transition temperatures, high critical magnetic fields, and high critical current densities. Methods for large scale production of wires with layers of these compounds have been developed. Niobium wires with layers of Nb3Al and Nb3(Al,Ge) were produced in a continuous dip and diffusion process. Conductors with layers of V3Ga and Nb3Sn were obtained in the form of multifilament wires through a selective solid state diffusion. Electrical and mechanical properties of these conductors such as transition temperature and current carrying capacity in transverse magnetic fields as well as elasticity and tensile strength were investigated. For individual titles, see N77-14894 through N77-14897.

N77-14894# Siemens A.G., Erlangen (West Germany).
Nb3Al AND Nb3(Al, Ge) SUPERCONDUCTORS [Nb3Al-UND Nb3(Al,Ge)-SUPRALEITER]
Alfred Mueller *In its* Develop. of High Field Superconductors Aug. 1976 p 14-82 refs In GERMAN (For primary document see N77-14893 05-76)
Avail: NTIS HC A12/MF A01; ZLDI, Munich DM 47,50

A simple, continuous fabrication method was developed for an electric conductor with a superconducting A-15 phase, Nb3Al(Ge). The experimental work described includes the search for A-15 phase synthesis, a preparation method derived from this for a conductor with an A-15 surface layer, and superconductivity of the conductor as a function of the parameters of the method.
ESA

N77-14895# Siemens A.G., Erlangen (West Germany).
V3Ga SUPERCONDUCTORS [V3Ga-SUPRALEITER]
Manfred Wilhelm *In its* Develop. of High Field Superconductors Aug. 1976 p 83-158 refs In GERMAN (For primary document see N77-14893 05-76)
Avail: NTIS HC A12/MF A01, ZLDI, Munich DM 47,50

The solid state diffusion method was applied to the preparation of V3Ga filament conductors. Work was carried out permitting quantitative determination of formation and growth of superconducting V3Ga layers. The deformability and recrystallization behavior of copper-gallium alloys was investigated. A technology was developed to manufacture composite wires from (Cu, Ga) matrix and one or more vanadine cores of greater length. The effect of annealing time, temperature, and composition of the gallium sourer on transition temperature and current carrying capability was investigated for single and multiple core conductors. The diffusion conditions were optimized so that the effective current density attains its maximum. Mechanical tests were carried out.
ESA

N77-14896# Siemens A.G., Erlangen (West Germany).
Nb3Sn SUPERCONDUCTORS [Nb3Sn-SUPRALEITER]
Guenther Ziegler *In its* Develop. of High Field Superconductors Aug. 1976 p 159-208 refs In GERMAN (For primary document see N77-14893 05-76)
Avail: NTIS HC A12/MF A01; ZLDI, Munich DM 47,50

The suitability of the solid state diffusion method for Nb3Sn by diffusion from tin out of a bronze matrix was found by tests with several materials. The technological principles of the method are determined. The kinetics of layer formation as well as the dependence of the transition temperature and the current density on the diffusion parameters were investigated. The limitation of Nb3Sn formation by the tin reservoir was determined quantitatively, and from this a formalism for the calculation of Nb3Sn conductors was developed. The most favorable shape of the conductor prototypes are surveyed in connection with stabilization and mechanical properties.
ESA

N77-14897# Vacuumschmelze G.m.b.H., Hanau (West Germany). Entwicklungsabteilung.
CONDUCTOR FABRICATION TECHNOLOGY [TECHNOLOGIE DER LEITERHERSTELLUNG]
Engelbert Springer *In* Siemens Develop. of High Field Superconductors Aug. 1976 p 209-226 refs In GERMAN (For primary document see N77-14893 05-76)
Avail: NTIS HC A12/MF A01; ZLDI, Munich DM 47,50

Methods are reported for preparation of composite wires of copper-gallium matrix and vanadine cores as well as copper-tin matrix and niobium cores. In the course of a subsequent diffusion annealing these wires are transferred to diffusion layers in filamentary superconductors.
ESA

N77-14898# Connecticut Univ., Storrs.
ELECTRON DISLOCATION INTERACTIONS AT LOW TEMPERATURES Progress Report
1976 33 p refs Sponsored by ERDA
(COO-2305-3) Avail: NTIS HC A03/MF A01

The interaction of moving dislocation with electrons in lead alloys and in niobium was measured - the latter, for the first time between 1.5 and 4.2 K which was compared with theories of dislocation motion. Also, the interaction of moving dislocations with flux lines was shown to be consistent with the mobile dislocation density in a crystal, which was the first independent measure of the mobile dislocation density in a crystal.
ERA

N77-14899# Lehigh Univ., Bethlehem, Pa.
RADIATION EFFECTS IN MOS GATE INSULATORS Final Report, 3 Apr. 1974 - 28 Feb. 1975
Frederick M. Fowkes, Walter E. Dahlke, and Sidney R. Butler Sep. 1975 85 p refs
(Contract DAAG39-74-C-0105; DNA Proj. NWED-QAXTA007) (AD-A026017; HDL-CR-75-105-1) Avail: NTIS HC A05/MF A01 CSCL 09/1

Metal-alumina-silicon structures were made by a CVD process. Comparison with reported data on MAS devices prepared in

industrial laboratories indicate that the latter samples consistently exhibit significantly lower initial charge, higher charge injection thresholds, and lower injected charge densities. Photodepopulation measurements of electrons injected under high positive bias indicated that some of the electron traps were associated with residual water generated in the CVD process and therefore might be minimized by some post-deposition process. The effect of Gamma-irradiation up to 10 to the 7th power rads (under floating gate conditions) of thin MOS structures with aluminum or chromium metallization was determined by changes in the fixed charge or interface state density. Chemical micro-analyses and C-V measurements were combined to determine the role of sodium and of aluminum in the mobile charges observed in MOS gate insulators by 300C bias stress treatments, before and after exposure to 10 to the 6th power rads of ionizing radiation from a 60Co source. GRA

N77-14900# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

THIN-FILM SEMICONDUCTOR DETECTORS FOR 10.6 MICROMETER RADIATION Ph.D. Thesis

Jon C. Zimmerman 1975 152 p refs

(AD-A026266; AFIT-CI-76-45) Avail: NTIS HC A08/MF A01 CSCL 17/5

Thin-film semiconductor detectors were investigated for use as room temperature thermal detectors for infrared radiation at 10.6 micrometers. Some of the materials investigated were antimony trisulfide, germanium, tellurium, and selenium. The most successful devices were fabricated from 400 A bismuth, 6800 A selenium, and 1500 A gold on an alumina substrate. The method of operation was also studied and it was found that devices operating in the avalanche region of the Schottky diode formed between selenium and bismuth provided the best responsivity and frequency response. The responsivity of the device was measured as a function of the geometry and the modulation frequency. A comprehensive thermal analysis of thin-film thermal detectors has been made and a computer program written to calculate the responsivity of arbitrary devices. The analysis is completely general and is applicable to multilayered devices and diode as well as thermal change of resistance type of devices. GRA

N77-14901# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.

HETERONUCLEAR DIPOLAR MODULATED CHEMICAL SHIFT SPECTRA FOR GEOMETRICAL INFORMATION IN POLYCRYSTALLINE SOLIDS Interim Technical Report

M. E. Stoll, A. J. Vega, and R. W. Vaughan Jul. 1976 31 p refs

(Contract N00014-75-C-0960; NR Proj. 056-605)

(AD-A027401; TR-2) Avail: NTIS HC A03/MF A01 CSCL 07/4

A double resonance multiple pulse nuclear magnetic resonance experiment is proposed and demonstrated which allows the use of heteronuclear dipolar interactions to determine geometrical, orientational, and motional information in polycrystalline solids. C13 - H1 double resonance experiments are performed in polycrystalline benzene and calcium formate to demonstrate the capabilities of the technique in its present form. GRA

N77-14902# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.

SURFACE DIFFUSION OF INDIVIDUAL ATOMS AND DIMERS: Re ON W(211)

Kaj Stolt, William R. Graham, and Gert Ehrlich Jun. 1976 71 p refs

(Contract DAAB07-72-C-0259; Grant NSF DMR-72-02937)

(AD-A027327; R-731; UILU-ENG-76-2219) Avail: NTIS HC A04/MF A01 CSCL 07/4

Quantitative observations of diffusion on the W(211) have been made both for rhenium atoms and for rhenium dimers formed from atoms in adjacent (111) channels, using the field ion microscope to reveal the surface on the atomic level. GRA

N77-14903# Office of Naval Research, London (England).

THE 5TH INTERNATIONAL SYMPOSIUM ON BORON AND BORIDES

Forrest L. Carter and Charles Feldman 27 May 1976 10 p Symp. held at Talence (France), 8-11 Sep. 1975

(AD-A026961; ONRL-C-12-76) Avail: NTIS HC A02/MF A01 CSCL 07/4

The Fifth International Symposium on Boron and Borides was held at the University of Bordeaux, Talence, France, on 8-11 September, 1975. The conference emphasized the relation of crystal structure and chemical bonding to properties and applications, but other major topics included reaction kinetics in the preparation of amorphous boron, vibration and optical spectra, band structure, and magnetic and semiconducting properties. In the area of applications the main topics included the surface treatment of steel for wear resistance, the hardness of boron and borides, and the protection of boron fibers in metallic composite materials. GRA

N77-14904# California Univ., Irvine. Dept. of Chemistry.

LASER INDUCED FLUORESCENCE EMISSION SPECTROSCOPY OF H2CO(A1A2). 1: COMPARISON OF THE RADIATIVE TRANSITION RATES FROM TWO NEARLY DEGENERATE VIBRONIC LEVELS Interim Report, 1 Apr. 1976 - 31 Mar. 1977

Kenneth Y. Tang and Edward K. C. Lee 10 Jul. 1976 12 p refs Sponsored in part by NSF

(Contract N00014-75-C-0813; NR Proj. 014-506)

(AD-A026877; B-6) Avail: NTIS HC A02/MF A01 CSCL 20/12

Emission spectra from two vibronic levels of H2CO have been obtained after a tunable dye laser excitation. From the measurement of the emission intensity distribution under varying pressures, the radiative transition rate from the 5(1) level was found to be approximately 1.8 times greater than that from the 1(1)4(1) level. This confirms the earlier suggestion that v sub 5 mode enhances the emission rate, inconsistent with the expectation based on the absorption. GRA

N77-14905# Florida Univ., Gainesville. Electron Device Research Center.

PHYSICAL MODELS OF MOSFET DEVICES Final Report

David P. Kennedy and Fredrik A. Lindholm Oct. 1975 161 p refs

(Contract DAAG39-74-C-0193; DNA Proj. NWED-QAXTB029; HDL Proj. 314428)

(AD-A026914; EDRC-75-3; HDL-CR-75-193-1) Avail: NTIS HC A08/MF A01 CSCL 20/12

This report presents research directed toward the development of a mathematical model for MOSFET operation that is based upon physical mechanisms associated with the operation of this semiconductor device. A principal objective of this effort is to develop a simple engineering type model that implicitly contains two-dimensional mechanisms known to exist in this device. Included in this objective is the development of a lumped network representation for MOSFET operation that can be expanded to include these two-dimensional mechanisms of operation. Chapter 1 of this final report outlines a mathematical model for MOSFET operation that appears applicable into the weak inversion mode of operation. Chapter 2 presents a quantum mechanical solution for the inversion layer carrier distribution in a MOSFET. Chapter 3 provides a first step toward the development of a lumped network representation for the MOSFET that is based upon first principles. GRA

N77-14906# California Univ., Berkeley.

LOW-ENERGY ELECTRON DIFFRACTION, AUGER ELECTRON SPECTROSCOPY AND THERMAL DESORPTION STUDIES OF CHEMISORBED CO2 AND O2 ON THE (111) AND STEPPED (6(111)X(100)) IRIDIUM SURFACES Interim Report

D. I. Hagen, B. E. Nieuwenhuys, G. Rovida, and G. A. Somorjai Apr. 1976 38 p refs Submitted for publication

(Contract N00014-75-C-0890; NR Proj. 056-568)

(AD-A026534) Avail: NTIS HC A03/MF A01 CSCL 07/4

The adsorption of CO, O2 and H2O was studied on both (111) and (6(111)x(100)) crystal faces of iridium. The techniques used are LEED, AES and thermal desorption. Marked differences were found in surface structures and heats of adsorption on these crystal faces. Oxygen is adsorbed in a single bond state on the (111) face. On the stepped iridium surface an additional bonding state with a higher heat of adsorption was detected

which can be attributed to oxygen adsorbed at steps. On both (111) and stepped iridium crystal faces the adsorption of oxygen at room temperature produced a (2x1) surface structure. The influence of steps on the adsorption behavior of CO and O2 on iridium and the correlation with the results found previously on the same platinum crystal faces are discussed. GRA

N77-14907# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.

REACTIONS OF GERMANIUM VAPOR WITH OXIDIZERS: PHOTON YIELDS AND NEW GeO BAND SYSTEM Interim Report

Gene A. Capelle and J. M. Brom, Jr. 24 Jun. 1976 42 p refs Prepared in cooperation with Calif. Univ., Santa Barbara, Calif.

(Contract F04701-75-C-0076; Grant AF-AFOSR-2724-74; DARPA Order 2843)

(AD-A027227; TR-0076(6751)-3; SAMSO-TR-76-132) Avail: NTIS HC A03/MF A01 CSCL 20/10

Germanium was reacted with N2O, O2, NO2, and NO in a flow system, which produced GeO. Chemiluminescence was observed from three electronic band systems of GeO Vibrational constants and T sub e values have been obtained. Photon yields for each of the three GeO band systems were measured to be small (-0.1% in all cases) and to be strongly pressure dependent in the 0.5 to 20 Torr region. Reaction of Ge vapor with F2 produced GeF chemiluminescence with a measured photon yield of .00068; the flames from Ge + Br2 and Ge + Cl2 were too weak to measure. Author (GRA)

N77-14908# Pennsylvania State Univ., University Park. Materials Research Lab.

TEMPERATURE COMPENSATED PIEZOELECTRIC MATERIALS Interim Technical Report, 1 Jul. - 31 Dec. 1975

G. R. Barsch and K. E. Spear Jun. 1976 55 p refs

(Contract F19628-75-C-0085; ARPA Order 2826)

(AD-A026464; RADC-TR-76-184; ITR-2) Avail: NTIS HC A04/MF A01 CSCL 20/12

In order to search for new temperature compensated materials for surface acoustic wave (SAW) devices with low ultrasonic attenuation and high electromechanical coupling, the following experimental and theoretical investigations were carried out: (1) Extensive crystal growth investigations were carried out for Li2SiO3, Ba2Si2TiO8, and Pb2KNb5O15, using both Bridgman and Czochralski methods. (2) The on-diagonal elastic constants c11, c22, c33, c44 and c55 and their temperature coefficients have been measured for Pb2KNb5O15. The temperature coefficient of c11 is positive, indicating that temperature compensated cuts should exist for this material. (3) The theoretical equations required for the experimental determination of the complete set of piezoelectric constants from X-ray measurements have been derived. For all 20 crystal classes exhibiting the piezoelectric effect explicit expressions are given for the longitudinal and transverse piezoelectric effect, corresponding to parallel-field and perpendicular-field reflection, respectively. GRA

N77-14909# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.

ON SHOCK WAVES AND ACOUSTOELECTRIC DOMAINS IN PIEZOELECTRIC SEMICONDUCTORS

M. F. McCarthy (Natl. Univ. of Ireland, Galway) and H. F. Tiersten May 1976 28 p refs

(Contract N00014-76-C-0368; NR Proj. 318-009)

(AD-A026687; TR-17) Avail: NTIS HC A03/MF A01 CSCL 20/12

The theory of shock waves is applied to the one-dimensional version of the general nonlinear electrostatic equations for deformable semiconductors employed in a recent acceleration wave analysis of acoustoelectric domains in piezoelectric semiconductors. Consequently, the mechanical and dielectric nonlinearities are included in the shock wave analysis as well as the semiconduction nonlinearity. Equations are derived for both the propagation velocity and the amplitude of the shock wave as a function of the jumps in certain variables across, and the state of the material immediately ahead of, the wavefront. Expressions are obtained for the jumps in other variables across the shock front, such as the electric field, in terms of the amplitude of the shock. Some physical information concerning the evolutionary behavior of certain simplified types of shock is extracted from the rather complicated shock amplitude equation. When the analysis is specialized to the case of infinitesimal shocks, the results reduce to those obtained in the aforementioned analysis of acceleration waves in piezoelectric semiconductors with linear piezoelectric response. Author (GRA)

N77-14910# National Academy of Sciences - National Research Council, Washington, D.C. Office of Chemistry and Chemical Technology.

STATUS AND FUTURE POTENTIAL OF CRYSTALLOGRAPHY

May 1976 80 p refs Conf. held at Chantilly, Va., 10-11 Feb. 1975

(Contract NSF C-310)

(PB-253710/8) Avail: NTIS HC A05/MF A01 CSCL 20B

The broad relationship of crystallography to numerous other scientific disciplines is discussed by describing its inherent diversity of subject matter for experimental and theoretical investigation and by outlining numerous promising areas for future research. Topics discussed include biological macromolecules, chemical crystallography, diffraction physics, earth sciences, and materials research. GRA

N77-14911# Wisconsin Univ., Madison. Dept. of Chemistry.

2ND INTERNATIONAL SUMMER INSTITUTE IN SURFACE SCIENCE (ISISS 1975) Final Report, 1 May 1975 - 30 Apr. 1976

Ralf Vanselow 9 Jul. 1976 10 p refs

(Grant N00014-75-G-0011; NR Proj. 392-011)

(AD-A026901) Avail: NTIS HC A02/MF A01 CSCL 05/2

At the second International Summer Institute in Surface Science, twenty-one leading scientists presented tutorial review talks on gas-solid interfaces. Paper topics: 'The Imaging Process in Field Ion Microscopy: From the FEM to the ATOM-Probe', 'Influence of Adsorption on the Crystal Shape', 'Surface diffusion of Metals', 'Molecular Beam Epitaxy', 'Physical Adsorption: A Modern Study', 'Statistical Thermodynamics of Gases Adsorbed on Well-Characterized Surfaces', 'Chemisorption Theory', 'Chemical Surface Reactions in the Presence of High Electric Fields', 'Field Emission Electron Energy Distribution', 'Surface Analysis Using Electron Beams', 'Surface analysis by Means of Ion Beams', 'Surface Analysis by Means of Photoemission', and 'Other photon Stimulated Processes', 'Neutral Particle Scattering: A Probe for Surface Structure and Reactivity', 'Surface Analysis by Means of Magnetic Resonance Techniques', 'Quantum Physics and Chemistry of Surfaces', 'Electronic Structure of Semiconductor Surfaces: Photon and Electron Spectroscopies', 'Structural Studies of Clean and Overlayered Surfaces', 'Contributions of Surface Physics to Catalysis', 'Controlled Atmosphere Electron Microscopy to Catalytic Reactions', 'Surface Effects in Controlled Thermonuclear Fusion', 'Surface Science in the Electronics Industry'. Author (GRA)

N77-14912# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

SPECTROGRAPHIC INVESTIGATION OF (GD.8EU.2)2 (MOO4)3 M.S. Thesis

Kenneth L. Thomas Mar. 1975 78 p refs

(AD-A026622; GEO/PH/75-9) Avail: NTIS HC A05/MF A01 CSCL 20/6

A basic spectrographic study of ferroelectric/elastic (Gd(.8)-Eu(.2))2(MoO4)3 was completed. The absorption and emission were looked at under different temperatures and excitation. For absorption the Cary 14 was used and data was taken at room temperature, 77 deg. K, and 4.2 deg. K. Excitation for emission studies was provided by an argon laser and a high pressure mercury lamp. Polarized and unpolarized spectra were taken at room temperature and at 77 deg. K. The main groups of lines were located in the following areas: 590 nm, 615 nm, and 700 nm. Some dual peaks were observed indicative of the two lattice sites Eu occupies in the ferroelectric phase. When the crystal was heated above the transition temperature the fluorescence showed mainly temperature broadening effects. Considering the results of the experiments conducted, Gd2

(MoO4)3 is an attractive laser host material and EU3- is a promising active ion. GRA

N77-14913# Arizona State Univ., Tempe. Dept. of Physics.
PHYSICAL PROPERTIES OF SURFACES BY ELECTRON DIFFRACTION Final Scientific Report, 1 Jan. 1971 - 31 May 1976
John M. Cowley May 1976 10 p refs
(Grant AF-AFOSR-1996-71; AF Proj. 9761)
(AD-A026360; AFOSR-76-0704TR) Avail: NTIS HC A02/MF A01 CSCL 20/8

A dynamical diffraction theory for electron diffraction from surfaces has been developed and used to calculate diffraction intensities and image contrast. An experimental system has been constructed for the examination of the surface structure of crystals, combining medium energy electron diffraction with scanning electron microscopy. A new technique, involving the use of diffracted electron beams to provide dark-field scanning images of the surfaces of crystals, has been introduced, evaluated theoretically and demonstrated experimentally as a means for the detection of crystal imperfections and structural modifications. Applications of this new technique, in combination with diffraction and conventional, secondary-electron scanning electron microscopy have been made to the study of the structure of the surfaces of several materials, to the oxidation of copper crystals and to a precipitation of one phase from solid solution. GRA

N77-14914# Rome Air Development Center, Griffiss AFB, N.Y.
ACOUSTIC LOSS AND FREQUENCY OFFSET MEASUREMENTS ON 5 MHz QUARTZ RESONATORS Report, Sep. 1974 - Apr. 1976
Richard N. Brown May 1976 24 p refs
(AF Proj. 5621)
(AD-A027355; RADC-TR-76-164) Avail: NTIS HC A02/MF A01 CSCL 09/1

Acoustic loss and frequency offset measurements are reported for several types of synthetic quartz resonators operating at 5 MHz in an attempt to answer several questions concerning the failure of swept electronic grade quartz to be radiation resistant. The loss was recorded from the temperature of liquid helium to 400K. The offset of the resonant frequency with electron irradiation was measured up to a dose of 1 MRad. Irradiations were performed, for the most part, with the resonator in an oven at 55C, but one resonator was irradiated in a dewar at 17K. The results indicate the swept electronic grade resonators of recent manufacture are radiation resistant. Author (GRA)

N77-14915# Electronic Systems Div., L. G. Hanscom Field, Mass.
SOME MATHEMATICAL CONSIDERATIONS REGARDING THE CALCULATION OF PERMANENT DAMAGE OF DEVICES DUE TO EMP PULSES
Ira Kohlberg Jul. 1976 36 p refs
(AD-A027534; ESD-TR-76-167) Avail: NTIS HC A03/MF A01 CSCL 09/1

A mathematical analysis of the failure of semiconductor junctions due to EMP induced pulses is presented. Included in this discussion are: the effects of finite-size p-n junctions on maximum temperature buildup; an evaluation of interpulse cooling; and a determination of the response of these devices to damped periodic waveforms. Limitations of the results are presented. Such information will be generally useful for performing preliminary damage assessment and/or screening of devices. GRA

N77-14916# Newcastle-upon-Tyne Univ. (England). Dept. of Electrical and Electronic Engineering.
NEW PASSIVATION METHODS FOR GaAs Final Technical Report, 1 Jan. - 31 Dec. 1975
B. Bayraktaroglu, A. Colquhoun, A. F. A. B. El-Safti, E. Kohn, and H. L. Hartnagel Jan. 1976 44 p refs
(Grant DA-ERO-75-G-038; DA Proj. 1T1-61102-B-31E)
(AD-A026030) Avail: NTIS HC A03/MF A01 CSCL 20/12

The fabrication of high-quality oxides on GaAs with good electrical interface properties was investigated. The physical properties of our new anodix anodic oxidation were investigated by a systematic study of relevant parameters. The new electrolyte, termed AGW (anodization by glycol and water) was applied to InP with some useful success. Attempts were made to incorporate other elements in the oxide in view of better high temperature stability. The results demonstrate some interesting effects regarding the drift of ions across oxides. Higher temperature annealing was found possible when using N2 or Ar as ambient gas. Two approaches of fabricating MOSFET's have resulted in preliminary transistor characteristics. Author (GRA)

N77-14917# Paris VI Univ. (France).
ELECTRONIC AND VIBRATIONAL PROPERTIES OF SOLIDS UNDER HYDROSTATIC PRESSURE Final Technical Report, Apr. 1975 - Apr. 1976
J. M. Besson, H. D. Fair, M. Zigone, R. LeToullec, P. Jaszcyn-Kopec, A. Chevy, A. Mejatty, A. Segura, and R. Beserman May 1976 48 p refs
(Grant DA-ERO-75-G-059; DA Proj. 1T1-61102-B-11B)
(AD-A026511) Avail: NTIS HC A03/MF A01 CSCL 20/12

The pressure variation of the absorption edge and exciton levels in lamellar GaS and GaS has been measured up to 40 kilobars at 300 K. The pressure coefficient of the transition is - 11 + or - 1.5 x 10 to the minus 6th power eV/bar. A discussion of the values of the pressure coefficients for direct and indirect transitions in Gallium chalcogenides is given. Raman scattering on single phonon is also investigated and dispersion curves of Gallium chalcogenides under pressure are given. A phase transition in delta-GaSe under hydrostatic pressure is observed. The pressure dependence of impurity-induced vibrational modes in II-VI compounds is studied by means of Raman spectroscopy and as well as the luminescence of these compounds. Author (GRA)

N77-14918# National Bureau of Standards, Washington, D.C.
MOLECULAR DYNAMICAL STUDIES OF ENERGY TRANSPORT IN A CRYSTALLINE SOLID Final Report
D. H. Tsai and R. A. MacDonald Apr. 1976 22 p refs Presented at Symp. on Computer Simulation for Materials Applications, Gaithersburg, Md., 19-21 Apr. 1976 Submitted for publication
(Contract AT(49-13)-3003)
(PB-256917/6) Avail: NTIS HC A02/MF A01 CSCL 07D

The classical equations of motion for the atoms are solved numerically under appropriate initial and boundary conditions, and the properties of the lattice and the transport of energy are determined from averages of the atomic motion. It was found that a disturbance in thermal energy propagates either by diffusion or as a temperature wave with second sound velocity. A disturbance in potential energy propagates as a stress wave with first sound velocity. In addition, it was found that longitudinal and transverse stress waves generate their own temperature waves through thermalization of the kinetic energy change accompanying the stress disturbances. GRA

N77-14088# Erlangen-Nuremberg Univ. (West Germany).
CRYSTAL GROWTH AT GREATER THAN 1 g
G. Mueller *In* ESA Mater. Sci. in Space Sep. 1976 p 213-216 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14094# Portsmouth Polytechnic (England). Dept. of Physics.
MEASUREMENT OF PROPERTIES OF HIGH-TEMPERATURE SOLUTIONS
D. Elwell *In* ESA Mater. Sci. in Space Sep. 1976 p 249-253 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

N77-14095# Technical Univ. of Denmark, Lyngby.
DIFFUSION GROWTH OF ORGANIC CHARGE-TRANSFER CRYSTALS
K. F. Nielsen *In* ESA Mater. Sci. in Space Sep. 1976 p 255-258 refs (For primary document see N77-14066 05-12)
Avail: NTIS HC A22/MF A01

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N77-14919# Technische Hogeschool, Delft (Netherlands).
A DERIVATION OF THE CONCEPT OF ENTROPY FROM THE AXIOMS OF CONTINUUM PHYSICS
G. D. C. Kuiken Sep. 1976 23 p refs
(WTHD-90) Avail: NTIS HC A02/MF A01

Classical foundations of thermodynamics and the concepts of continuum physics are discussed. The concept of entropy is founded on the continuum hypotheses especially the axiom of local equilibrium. Hence, the foundation of thermodynamics is completely described by the zeroth law of thermodynamics, which states the existence of equilibrium and temperature and the first law of thermodynamics which states for an isolated system the conservation of energy. The discussion shows that what engineers experienced and formulated as the second law of thermodynamics can be disregarded as a law of physics. Author

N77-14920*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TEST PARTICLE PROPAGATION IN MAGNETOSTATIC TURBULENCE. 2: THE LOCAL APPROXIMATION METHOD
A. J. Klimas, G. Sandri, J. D. Scudder, and D. R. Howell Nov. 1976 88 p refs Submitted for publication
(NASA-TM-X-71243; X-692-76-252; A-7349) Avail: NTIS HC A05/MF A01 CSCL 20J

An approximation method for statistical mechanics is presented and applied to a class of problems which contains a test particle propagation problem. All of the available basic equations used in statistical mechanics are cast in the form of a single equation which is integrodifferential in time and which is then used as the starting point for the construction of the local approximation method. Simplification of the integrodifferential equation is achieved through approximation to the Laplace transform of its kernel. The approximation is valid near the origin in the Laplace space and is based on the assumption of small Laplace variables. No other small parameter is necessary for the construction of this approximation method. The n'th level of approximation is constructed formally, and the first five levels of approximation are calculated explicitly. It is shown that each level of approximation is governed by an inhomogeneous partial differential equation in time with time independent operator coefficients. The order in time of these partial differential equations is found to increase as n does. At n = 0 the most local first order partial differential equation which governs the Markovian limit is regained. Author

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N77-14921 Nebraska Univ., Lincoln.
AN INVESTIGATION OF PRIORITY SCHEDULING METHODS FOR PROJECTS REQUIRING MULTIPLE LIMITED RESOURCES Ph.D. Thesis
Glen Eugene Andersen 1976 169 p refs
Avail: Univ. Microfilms Order No. 76-25855

Four different priority scheduling methods were examined using data on an actual group of data processing systems projects. Three of the scheduling methods examined are in use and are the first-come-first scheduled method, the rate of return method, and the rate of return with replacement method. The fourth scheduling method was the present worth maximization method. No evidence was found indicating that this method was defined previously or applied to the project scheduling problem. The same group of projects was scheduled with the four different scheduling methods with all scheduling conventions, not unique to a particular method, applied consistently. The scheduled projects required varying amounts of three different types of manpower resources, all of which were in limited supply. The primary evaluation of the scheduling methods was based on the total net present worths of project returns resulting from the application of the respective methods. Dissert. Abstr.

N77-14922# Tennessee Univ., Knoxville. Transportation Center.
THE MANAGEMENT OF LARGE-SCALE INTERDISCIPLINARY RESEARCH
Jul. 1976 147 p refs Conf. held at Knoxville, Tenn., 14-17 Oct. 1975
(Grant NSF MN-44410)
(PB-256573/7; TC-76-019) Avail: NTIS HC A07/MF A01 CSCL 05A

This conference focused upon the issues and problems related to the management of interdisciplinary research. The conference proceedings comprise both resource papers and proceedings from formal workshops. GRA

N77-14923# Contract Research Corp., Belmont, Mass.
AN EVALUATION OF MONITORING SYSTEMS IN SELECTED REGIONAL PROGRAM AREAS Final Report, Aug. 1975 - May 1976
Jack Donovan May 1976 384 p
(Contract DHEW/R03-75-130-76-2)
(PB-255981/3; HEW/Reg-3-75/2) Avail: NTIS HC A17/MF A01 CSCL 05K

Regional information needs as well as information management problems were identified that interface with a manager's capability to function in all the expected roles. Three program areas were concentrated on: (1) child support enforcement; (2) head start; and (3) vocational education. GRA

N77-14924# Naval Postgraduate School, Monterey, Calif.
MODELLING, TRANSFORMATIONS, AND SCALING DECISIONS IN CONSTRAINED OPTIMIZATION PROBLEMS M.S. Thesis
John Joseph Timar Mar. 1976 98 p refs
(AD-A026396) Avail: NTIS HC A05/MF A01 CSCL 05/1

This thesis investigates various modelling choices and modelling decisions that can be used by defense analysts when solving nonlinear optimization problems. A discussion is given of separable programming, goal programming, and linear fractional programming models, and a description of the manner by which they can be converted to equivalent linear programs. Transformations of variables recommended in the literature are tested on several well-known test problems using GRG and SUMT nonlinear programming codes. The sensitivity of the GRG code to scaling, rotation of coordinates, and translation of variables is examined. Transformations to obtain separability of variables and experiments using a diagonalization algorithm to transform quadratic expressions into sums of squares are discussed. Barrier and penalty function transformations are also considered. GRA

N77-14925# Naval Postgraduate School, Monterey, Calif.
DESIGN CONSIDERATIONS FOR IMPLEMENTING A SHIPBOARD COMPUTER SUPPORTED COMMAND MANAGEMENT SYSTEM M.S. Thesis
Patrick Anthony Callahan Jun. 1976 51 p refs
(AD-A027290) Avail: NTIS HC A04/MF A01 CSCL 05/1

This report outlines an approach for the implementation of a shipboard computer supported management information system. The physical design specifications and design philosophy are

investigated. The application of mini-computer technology applied to the shipboard environment is presented. Specific administrative functions are recommended for automation. Author (GRA)

N77-14926# Carnegie-Mellon Univ., Pittsburgh, Pa. School of Industrial Administration.

COORDINATION AND ORGANIZATIONAL EFFECTIVENESS: A CANONICAL ANALYSIS Report, 1 Apr. 1976 - 31 Mar. 1977

Johannes M. Pennings 31 May 1976 35 p refs Presented at the Intern. Conf. on Coord. and Control of Group and Organ. Performance, Jul. 1976, Munich, West Ger.

(Contract N00014-75-C-0973; NR Proj. 170-801)

(AD-A026440; Rept-2) Avail: NTIS HC A03/MF A01 CSCL 05/1

This paper relates six coordination variables to seven effectiveness variables. Using a canonical correlations analysis it was possible to jointly examine the interrelatedness between the two sets of variables. Data from brokerage offices reveal that the frequency of meetings, participation in decision making and team effort are pertinent determinants of effectiveness as measured by static and dynamic archival indices. Author (GRA)

N77-14927# Ohio State Univ., Columbus. Disaster Research Center.

ORGANIZATIONAL COMMUNICATIONS AND DECISION MAKING IN CRISES Final Report, 1 Dec. 1974 - 31 Mar. 1976

Russell R. Dynes and E. L. Quarentelli May 1976 63 p refs (Contract N00014-75-C-0458; ARPA Order 2851)

(AD-A026984; DRC-Misc-18) Avail: NTIS HC A04/MF A01 CSCL 05/1

The primary focus of this study is on the response of organizations to crises, paying special attention to decision making and communication. The primary data base utilized involves materials collected in community-wide natural disasters by this Center in previous field work. From this data base, a series of propositions are derived, using decision making and communication, both as independent and dependent variables. To make future propositions more specific, the following dimensions must be taken into account: (1) The specific type of organization which experiences crises; (2) The different effect of various crisis agents; (3) The fact that crisis events always have a time and space referent; and (4) That intraorganizational functioning in crises is conditioned by the interorganizational context in which it must operate. A typology of group and organizational behavior in crises is derived from a cross classification of two variables: the nature of the crisis tasks undertaken by groups and the structure of these groups in the emergency period. An extension of this typology is explored, focusing on the importance of organizational coordination in crises. GRA

N77-14928# Defense Systems Management School, Fort Belvoir, Va.

PARTICIPATIVE DECISION MAKING: AN INVESTIGATION OF ITS EFFECTIVENESS IN THE PROGRAM MANAGEMENT OFFICE

Thomas W. Honeywill May 1976 41 p refs

(AD-A026381) Avail: NTIS HC A03/MF A01 CSCL 05/1

The purpose of this study project was to investigate two intervening variables to mediate the effectiveness of PDM: (1) The nature of the task and, (2) the subordinate personality characteristics need for independence. Secondly, to investigate the degree of presence of the variables in the PMO. The study showed that PDM will have positive effects on job performance and attitude when (1) the task environment is characterized by uncertainty, complexity, and rapidly changing technology and: (2) the subordinates possess a moderate or high need for independence. The study showed that the task environment of the PMO is permeated with uncertainty, complexity and changing technology. Additionally, through the sample use of Vroom's need for independence questionnaire it was determined that as many as 90% of PMO subordinates possess a moderate to high need for independence. The study concludes that PDM is a potentially effective management strategy that warrants serious consideration by program managers. Author (GRA)

N77-14929# Defense Systems Management School, Fort Belvoir, Va.

AN EVALUATION OF USAF INTERNATIONAL COOPERATIVE R AND D

George Fletcher Hunter Nov. 1975 64 p refs

(DSMS Proj. PMC-75-2)

(AD-A027130) Avail: NTIS HC A04/MF A01 CSCL 05/1

International cooperative research and development (ICR/D) is the collaboration of the U.S. and one or more of its allies in various R/D ventures to fulfill a common requirement. This report covers the purpose, scope and posture of the USAF in its dealings in ICR/D. The attitudes and barriers toward ICR/D are discussed in light of today's environment. Evolution of the ICR/D concept/process, types of cooperation and the mechanics of implementing ICR/D are also dealt with. The report concludes that attitudes/barriers to ICR/D are manageable, but without a change in outlook and posture, cooperation will tend to remain dormant. Author (GRA)

N77-14930# Defense Systems Management School, Fort Belvoir, Va.

THE INTEGRATION OF FRAGMENTED NON-MAJOR SYSTEMS: A MANAGEMENT PROBLEM

Kenneth Allen Gale Nov. 1975 54 p refs

(DSMS Proj. PMC-75-2)

(AD-A026566) Avail: NTIS HC A04/MF A01 CSCL 05/1

The Air Force has proposed the modular weapons concept as a weapon acquisition technique to provide technically sufficient weapons while avoiding the proliferation of individual weapon systems. This concept, being applied to the development of the Air Force's guided weapons program, is to develop a standardized set of weapon components. This will provide a mechanism for systematic upgrading of weapons by incorporating new technology into the modular weapon family in the form of a new module. It will require the integration of fragmented weapon components which can be developed throughout the Air Force Systems Command. This study looks at the integration process and at the management problems associated with implementing the modular weapons concept. The main source of problems is that the process is dynamic and requires the PM to work horizontally across the DoD organizations. This is difficult to accomplish on a broad scale in the bureaucratic form of organization. The concept is further compounded by the lack of an approved DoD plan for implementing the concept on a tri-Service basis. GRA

N77-14931# Defense Systems Management School, Fort Belvoir, Va.

MULTIPLE SMALL PROJECT MANAGEMENT

George F. Christensen Nov. 1975 43 p refs

(AD-A026564) Avail: NTIS HC A03/MF A01 CSCL 05A

This report presents a series of actions that the Product Manager may take to lessen this managerial workload. Methods involving the development of specialized task areas within the Product Manager's Office are also discussed. The actions specified should reduce the managerial work load and the organizational changes provide increased efficiency that will lead to greater mission accomplishment. It is concluded that an indepth examination of the need, development schedule, budget and acquisition strategy for each project may identify redundant and/or unnecessary tasks that can be eliminated from the management problem. Maximum utilization of support from the commodity commands and other services must be assured through communication and agreements. The development of specialists within the Product Manager's Office to handle specific and recurring tasks and maximum use of computer aids will increase efficiency and thus productivity. The ideas discussed have application to many Product/Program Managers faced with similar challenges. GRA

N77-14932# Defense Systems Management School, Fort Belvoir, Va.

CONTRACTING FOR OPERATIONAL AVAILABILITY: AN IMPOSSIBLE GOAL

Lawrence B. Residori May 1976 63 p refs

(AD-A026383; DSMS-PMC-76-1) Avail: NTIS HC A04/MF A01 CSCL 05/1

The purpose of this study project is to examine the feasibility of contracting for system operational availability as the ultimate

means of achieving system readiness at reduced support costs. The study was conducted based upon the author's experience in the field of establishing reliability, availability, and maintainability (RAM) requirements for inclusion in systems requirements documents. Review of DoD guidance pertaining to RAM and cost effectiveness was accomplished to provide the basic data for analysis. All the parameters which comprise RAM were examined in detail with emphasis on their interrelationship among themselves and logistics. Operational availability was identified as a most meaningful parameter in that it had a direct impact on system effectiveness. The study concluded that increased operational readiness at reduced life cycle cost can only be achieved by stating RAM/logistics requirements in terms of reliability and operational availability. It was further concluded that a systems effectiveness approach is required in order for the system design to be influenced by RAM/logistics requirements. The study recommends that DoD implement the concept of contracting for operational availability and a plan for implementation is presented. The implication of the study is that DoD is incorrectly emphasizing reliability and maintainability in an effort to reduce life cycle costs. Author (GRA)

N77-14933# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.
COMS: A COMPUTER-BASED OPERATIONS MANAGEMENT SYSTEM
Arnold C. Hax, Jonathan Golovin, Michael Bosyj, and Thomas Victor Jun. 1976 238 p refs
(Contracts N00014-75-C-0556; N00014-75-C-0661; MIT Proj. OSP-82491; NR Proj. 347-027)
(AD-A026250; TR-125) Avail: NTIS HC A11/MF A01 CSCL 05/1

This paper provides a detailed documentation, by means of flowcharts, of the basic modules for a hierarchical production planning and inventory control system. The system is based on the concept of hierarchization of decisions with linkage mechanisms between decision levels. GRA

N77-14934# Defense Systems Management School, Fort Belvoir, Va.
INFORMATION PROCESSING MODERNIZATION
John Gioia Nov. 1975 80 p
(AD-A026978) Avail: NTIS HC A05/MF A01 CSCL 09/2

Support costs have skyrocketed in the Department of Defense over the last five years. A substantial portion of the budget is now inflexible and must be used for obligated support costs such as retired pay personnel, and various levels of housekeeping support. The Chief of Staff, USAF is attempting to reduce resource costs wherever possible to put back into the system needed flexibility to develop systems for and to operationally support the combat forces. This paper looks at the administrative area and the possibility of identifying resource savings in the area of modernization. The general conclusion reached is that modernizing the administrative section in the Air Force at all levels is feasible and cost effective, provided each unit thus reconfigured is tailored to its local environment and that surveys pre-determine the cost benefits to be derived. In addition modernized administrative function should provide a synergistic savings in the long run. Program management depends quite heavily on administrative support to perform the mission. The trend toward administrative centers is clear and major Air Force acquisition offices are close to incorporating a new system. Hence program managers will have to depend on the new concept to obtain their administrative support required in the future. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N77-14935# British Library Lending Div., Boston Spa (England).
REDUNDANCY IN SCIENTIFIC AND TECHNICAL LITERATURE
C. W. Cleverdon and J. S. Kidd Jan. 1976 73 p refs
(BLL-BLRD-5282) Avail: British Library Lending Div., Boston Spa, Engl.

A test was carried out to investigate the assumption that there is a significant level of redundancy (or notional overlap) between documents. The first part derives a measure of notional overlap, which is then applied to a test collection of 455 documents in the general subject area of computer applications to air traffic control. The conclusions were that notional overlap exists, but there appear to be very few cases of extreme redundancy, and at the document level, there is little possibility of practical applications. Author

N77-14936 British Broadcasting Corp., Kingswood (England). Engineering Div.
IMPROVEMENTS TO AUTOMATIC TARIF
R. P. Marsden Nov. 1976 8 p ref
(BBC-RD-1976/30) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Automatic Tarif is an equipment used to make frame-by-frame corrections of color-balance, gain, and lift errors, in the color separation output signals of a telecine. Modifications made to the automatic Tarif equipments in service use so as to make their operation more acceptable on a wider range of subject matter are described. An attempt to correct automatically for color balance errors in the output signals of an electronic color camera is reported. A possible application is the correction of hue errors caused by rapid changes in the color temperature of the scene illuminant. Although it has been found that, for most scenes, color balance errors are significantly reduced, the overall standard obtained was below that expected from a correctly aligned camera. The use of fully automatic correction would therefore be confined to situations where it was impossible to realign the camera manually or semiautomatically. Author

N77-14937 British Library Lending Div., Boston Spa (England).
STORAGE OF LITTLE-USED LITERATURE IN THE DDR
G. Schwarz Nov. 1976 13 p refs Transl. into ENGLISH from Zentralblatt fur Bibliothekwessen (W. Germany), v. 89, no. 9, 1975 p 397-401
(BLL-RTS-10285) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The capacity of the storage library is determined by the space requirement of the German State Library for accommodation of its little-used stocks and secondly the requirement of the remaining scientific libraries for the accommodation of foreign-language information sources. The basic stock of the storage library will be formed by publications from the German State Library, which will be arranged in accordance with the pressmarks of this library. The determination of the capacity will be further affected by whether the storage library is required to take over additional functions. Five million volumes will be taken as the capacity for the initial building stage. The annual input from the scientific libraries (excluding the German State Library) may be of the order of 250,000 volumes. The storage library will have a telex connection with the research libraries, in order to accelerate lending (communications technique) and book and personal elevators. Author

N77-14938 British Library Lending Div., Boston Spa (England).
PHOTOCOPYING AND COPYRIGHT: TOWARDS A NEW LEGISLATION
Oct. 1976 11 p Transl. into ENGLISH from Bulletin du Livre (France), v. 267, 1975 p 27-31
(BLL-RTS-10266) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 7 European or 30 UK BLL photocopy coupons

Reprographic machines such as photocopiers, offset printing machines, and telecopiers and the extent of their use were studied. The cumulative effect of large numbers of individuals making single copies constitutes a significant degree of harm. The member countries of the International Committee on Copyright believe that reproduction by photocopying of works protected by copyright has a bearing on the resolutions for the protection of library and artistic works which concern the right to copy. They suggest that countries in which the photocopying process is widely used

could encourage the setting up of collective machinery for controlling and administering the right of renumeration. S.M.

N77-14939# Transportation Research Board, Washington, D.C.
TRISNET. DIRECTORY TO TRANSPORTATION RESEARCH INFORMATION RESOURCES
P. E. Irick and E. P. Pascal May 1976 69 p
(Contract DOT-OS-60072)
(PB-255172/9; DOT-TST-76-82) Avail: NTIS HC A04/MF A01 CSCL 05B

Entries for approximately 50 information resources whose services and products are generally available to the user community for transportation research information are given. They were prepared as an accessory for TRISNET (an evolving national network of transportation research information services). Two indexes are provided for the directory entries, an alphabetical index that is arrayed in the order of acronyms shown at the upper right hand corner of each entry page, and a classified index that locates directory entries in terms of subject orientation, geographical class, and types of available services and products. GRA

N77-14940# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE SCIENCE OF INFORMATION RETRIEVAL Final Report
K. A. Pullen and C. W. Hoffman Jun. 1976 93 p refs
(DA Proj. 1E8-65803-M-728)
(AD-A027589; BRL-1896) Avail: NTIS HC A05/MF A01 CSCL 05/2

The science of recovery of technical information is examined in terms of size of the information bank, definitiveness, specificity, the mathematics of recovery from an information system, and decision theory. It is shown that the search decision is very sensitive to the quality of idea indexing. The factors leading to a profitable search decision are developed, and guidelines for maximizing indexing quality in this sense are formulated. Methods of use of the indexes generated to optimize availability of indexed information sources are considered, and alternatives for various sizes and kinds of libraries and information centers are reviewed. An experiment which may prove useful for measuring system effectiveness is described. The experiment can also give insight on how to improve rates of information transfer and how to increase capability of information assessment. GRA

N77-14941# Army Electronics Command, Fort Monmouth, N.J.
KWIC INDEX OF TECHNICAL PAPERS, INTERNATIONAL WIRE AND CABLE SYMPOSIA (1952-1975)
Elmer F. Godwin May 1976 105 p
(AD-A027558; ECOM-4414) Avail: NTIS MF A01 CSCL 05/2

This bibliography lists 685 technical papers presented at International Wire and Cable Symposia from 1952 through 1975. The citations are grouped by symposium number and two indexes are provided: a Key Word in Context (KWIC) index for retrieval of titles by subject, and an author index. Among the broad subject areas covered in the bibliography are: military and aerospace electronics; telephone communications; electronic wiring; cable design, test and performance; evaluation; and related fields of chemistry and electrical engineering. Author (GRA)

N77-14942# British Library Lending Div., Boston Spa (England).
EXPLORATORY MODELLING OF LIBRARY AND INFORMATION SYSTEMS IN THE UK. REPORT ON THE FEASIBILITY STUDY Report, 13 Jan. - 13 Jul. 1975
P. Layzell-Ward Dec. 1975 36 p refs
(BLL-BLRD-5280) Avail: British Library Lending Div., Boston Spa, Engl.

A feasibility study which examined the possibilities of using modelling techniques to increase understanding of the totality and dynamics of library and information systems in the U.K. is provided. The concept and process of modelling is described, and its potential value as a planning tool for those concerned with the development and operation of library and information services is assessed. Work on the development of a general model is reported, and the principal functional elements, flows and variables and their relationships are identified. An examination of the process of inter-library loan and a model of the mission of higher education are described. A short review of the quantitative data concerning library and information systems which are available to modellers was prepared. Discussions with those who may use modelling techniques are reported. An outline program for further work is presented. Author

N77-14943# British Library Lending Div., Boston Spa (England).
ON-LINE BIBLIOGRAPHIC SEARCHING. ASSESSMENT OF USE OF ON-LINE IN TEACHING LIBRARIANSHIP AND INFORMATION SCIENCES Final Report, Jun. - Dec. 1975
A. J. Wood Mar. 1976 79 p refs
(BLL-BLRD-5277) Avail: British Library Lending Div., Boston Spa, Engl.

The value of on-line bibliographic searching in teaching was investigated. The project was carried out during the summer and autumn terms 1975, and was the first of a series of short term experiments being set up, in United Kingdom Library and Information Schools, to explore ways of using on-line in teaching and its effect on future curricula. Students on the post graduate diploma in librarianship course took part in the project, which was primarily concerned with their experiences of and attitudes towards using Lockheed DIALOG. On-line bibliographic searching was included as part of an Automation in Libraries course, and for an Information Retrieval course on computer-based systems. A research methodology measuring student attitudes towards using on-line is described, and the results and conclusions are given. Measures used include an adjectival matrix and a likert type scale. Recommendations are made on the use of on-line bibliographic searching in the teaching situation, and suggestions for curriculum development are given. Author

N77-14944# British Library Lending Div., Boston Spa (England).
IDENTIFICATION OF INFORMATION FLOW: USER EVALUATION OF THE SOURCES OF SUPPLY Final Report, Oct. 1972 - Mar. 1976
C. C. Parker Mar. 1976 118 p refs
(BLL-BLRD-5288) Avail: British Library Lending Div., Boston Spa, Engl.

Patterns of information flow were identified among university researchers working in the multidisciplinary field of transportation, with a view to their improvement. Information flow was mainly investigated in the broad terms of 'sources of supply' such as personal libraries, the university library, conferences, colleagues, etc. The methodology was developed using a very basic model of information flow, which incorporated the concepts of information environments and users as individuals with differing personal 'models of the world' and 'ways of doing things'. Questionnaires, interviews and a relatively new budgetary game technique were developed and used to obtain a true perspective of information requirements in relation to other needs such as equipment and secretarial support. The very high importance of academic libraries in information flow was established relative to other support systems. Author

N77-14945# British Library Lending Div., Boston Spa (England).
SEARCH STRATEGY VARIATIONS IN CURRENT AWARENESS PROFILES IN THE FIELD OF CHEMISTRY Final Report, Oct. 1972 - Feb. 1976
D. Hartley and M. D. Hallas Jul. 1976 65 p refs
(BLL-BLRD-5294) Avail: British Library Lending Div., Boston Spa, Engl.

The necessity of sophisticated logical facilities for successful searching in chemistry were determined by investigating the search costs and performance of different types of search logic. A population of users was selected, and each user provided a statement of his interests, from which search profiles containing both left and right hand truncation were constructed using three different levels of search logic. The first profile constructed for each user contained simple AND, OR and NOT logic only, the second contained contextual logic, and the third contained quorum logic (plain coordinate matching). The simple logic profiles were first searched against a one month file of CA Condensates, and the references retrieved were sent to the users for relevance assessments. The contextual logic and quorum logic profiles were then searched in turn against the same file, and the new references retrieved were sent to the users for assessment. The UKCIS Housekeeping Suite of programs was used during the search runs to keep a record of each reference retrieved by

each profile version, and the user assessments were input to this suite. Author

N77-14946# British Library Lending Div., Boston Spa (England).
DESIGN OF INFORMATION SYSTEMS IN THE SOCIAL SCIENCES. RESEARCH REPORTS, SERIES A, NO. 5: THE PLANNING OF INDEXING AND ABSTRACTING SERVICES IN THE SOCIAL SCIENCES. COVERAGE, OVERLAP AND CONTENT
Apr. 1976 179 p refs
(BLL-BLRD-5290) Avail: British Library Lending Div., Boston Spa, Engl.

Information gathering, and design of information systems are discussed. Research was focused on published indexing and abstracting services. Questions were raised concerning organization, cost effectiveness, and size of the systems. B.B.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N77-14947# New York State Senate, Albany.
BALANCED GROWTH FOR THE NORTHEAST Final Report
1975 199 p refs Conf. Proc. of Legislative Leaders on the Future of the Northeast, Albany, N.Y., 11-13 Dec. 1975 Sponsored in part by EPA
(Grant EDA-OER-494-G-76-2)
(PB-255930/0; EDA/OER-76-007) Avail: NTIS HC A09/MF A01 CSCL 05C

A compilation of the proceedings of a conference of legislative leaders on the future of the Northeast. The topics presented revolve around the concepts of: (1) the need for balanced growth on a regional basis in the Northeast; (2) planning in this new perspective: and (3) the role of legislators in this new context. A discussion of the region's comparative disadvantages and advantages is conducted and suggestions are made concerning planning and policy alternatives. GRA

N77-14948# Argonne National Lab., Ill.
INVESTMENT PLANNING IN THE ENERGY SECTOR
E. Kahn, Mark Davidson, Arjun Makhijani, Philip Caesar, and S. M. Berman 1 Mar. 1976 105 p
(Contract W-7405-eng-48)
(LBL-4474) Avail: NTIS HC A06/MF A01

Consequences of investment decisions in the energy sector are examined. Various interpretations were offered to explain the break in historical energy consumption trends that began in 1974. Following an introductory section, configurations of electricity demand and utility investment behavior were analyzed that would lead to increasing costs and consequent effects on demand. Analytical model of electric utility investment, includes the basic equations for the model, application of the demand equation, the rate equation, and the projections for the coupling demand and rate equations. Some sectoral influences on utility demand and investment, a disaggregated analysis of electricity demand in three areas-residential demand, fuel substitution in high-temperature industrial processes, and by-product power generation in industry was undertaken. ERA

N77-14949# Army Construction Engineering Research Lab., Champaign, Ill.
THE ECONOMIC IMPACT FORECAST SYSTEM: DESCRIPTION AND USER INSTRUCTIONS Final Report
R. D. Webster, R. A. Mitchell, R. L. Welsh, Ewa Shannon, and M. L. Anderson Jun. 1976 39 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A027139; CERL-TR-N-2) Avail: NTIS HC A03/MF A01 CSCL 05/1

The Economic Impact Forecast System (EIFS) uses information from the Department of Commerce (Bureau of Census and Bureau of Economic Analysis); Department of Defense; and Department of Health, Education, and Welfare to calculate for DoD projects or actions the economic impacts caused by military activities. Using export-based location quotient techniques as the basis of its predictions, EIFS estimates the impact that expenditure of federal dollars has on local businesses, households, and governments in the areas of employment, personal income, total business volume, housing revenues, housing and business investments, and government expenses. The system currently has four operational functional areas: construction, operations and maintenance, mission change, and training. As development continues, the prediction equations will be redefined and additional functional areas will be developed. EIFS is one of three computer-based data systems which comprise the Environmental Technical Information System (ETIS). It is designed to provide information for assessing the environmental impacts of an Army project or activity in compliance with the National Environmental Policy Act (NEPA). The Environmental Impact Computer System (EICS) and the Computer-aided Environmental Legislative Data System (CELDS) are related systems developed at CERL. EICS is a basis for identifying and qualifying potential environmental impacts, and presents a broad, systematic approach to environmental analysis. CELDS allows access to abstracts of pertinent state and federal environmental legislation by means of keyword and topical searches. Author (GRA)

N77-14950# Mathematics and Computation Lab., Washington, D. C. Applied Economics Div.
THE INTERSECTORAL FEEDBACK MODEL Final Report
Teddy T. Su May 1976 118 p Sponsored by General Services Admin.
(PB-255859/1; GSA/FPA/MCL-TR-102) Avail: NTIS HC A06/MF A01 CSCL 05C

The economic impact of an industrial disruption was simulated. A computer simulation model was designed to measure changes in output and income for each sector. A series of repercussions, as reflected in backward and forward inpacts, was triggered by an exogenous change in demand for intermediate goods. Change in value added or income causes change in demand for final goods. Relative changes in output were compared to determine the extent to which an industry is disrupted. GRA

N77-14951# Defense Systems Management School, Fort Belvoir, Va.
USEFUL LIFE CYCLE COST ESTIMATES FOR DEFENSE SYSTEMS: AN EVALUATION
Carlton Franklin Roberson Nov. 1975 45 p refs
(AD-A026560) Avail: NTIS HC A03/MF A01 CSCL 05/1

This study analyzes and evaluates the concept and framework of Life Cycle Cost (LCC) estimate policy, guidance, and methodology efforts within the context of DoD major weapon system acquisition strategy. The analysis considered the general types of LCC estimates, the value of estimates in the decision making process, and the interaction of the OSD Assistant Secretaries and policy councils in LCC policy formulation and implementation. Current DOD publications, staff memoranda, and informal interviews with OSD officials were used as the basis for the analysis and evaluation. The study concludes that the ambiguity of current DoD directives regarding LCC estimate policy, guidance, and methodology responsibility makes it extremely difficult to understand where the DoD stands today with LCC. Although within OSD an overall LCC plan may exist in conjunction with well understood in-house responsibilities, in the opinion of the author it has not been clearly nor consistently promulgated within the whole of DoD. The emergence of a single, comprehensive LCC estimating concept which embodies all phases of weapon system acquisition and ownership does not appear to be forthcoming. GRA

N77-14952# Virginia Polytechnic Inst. and State Univ., Blacksburg. Div. of Mineral Engineering.
IMPACT OF RISING ENERGY COSTS ON THE DOMESTIC PRODUCTION OF SELECTED COMMODITIES
Christopher Haycocks May 1976 124 p refs
(Grant DI-BM-G0-133086)
(PB-256650/3; BM-OFR-88-76) Avail: NTIS HC A06/MF A01 CSCL 05C

The effect the increased power costs might have on the production of selected commodities in the United States was determined. The commodities in the study were: bituminous coal, iron and steel, phosphate, copper, and oil shale. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N77-14953# Economica, Inc., Tarrytown, N. Y.
REGIONAL ECONOMIC DEVELOPMENT AND FEDERAL LEGISLATION
Stanley L. Friedlander Mar. 1976 59 p
(Grant EDA-PF-506)
(PB-256179/3; EDA/OER-76-010) Avail: NTIS HC A04/MF A01 CSCL 05C

The relationship and potential impact of three legislative acts, the Comprehensive Employment and Training Act of 1973, the Housing and Community Development Act of 1974, the Trade Act of 1972, and three bills, the Public Works Employment Act of 1976, the Balanced Growth and Economic Planning Act of 1975, and the Land Resource Planning Assistance Act of 1975, on regional economic development and, in particular on economic development districts was analyzed. This legislative analysis was to improve the effectiveness of economic development districts by integrating funds and programs established by Federal legislation with programs operated by the Economic Development Administration. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N77-14954 State Univ. of New York, Buffalo.
RECYCLING: ENCOURAGING AN INFANT INDUSTRY Ph.D. Thesis
Nils Albert Parr 1975 196 p
Avail: Univ. Microfilms Order No. 76-20312

Conditions in present market structures which tend to encourage the use of virgin raw materials and tend to inhibit waste management and recycling were explored. Eleven recommendations are presented as policy alternatives for legislators interested in changing market structures to encourage recycling. The most innovative of these recommendations, an Environmental Tariff, was perceived and defended as a variation of a Bergson-Samuelson Social Welfare Function. The Environmental Tariff was then defended in the context of international trade in which the tariff was imposed by society on imports of virgin raw materials from earth in a variation of the Spaceship Earth concept. The tariff was then discussed in relation to the political realities of the day, and the suggestion that such a tariff may be implicitly employed at present by the actions of such cartels as the Organization of Petroleum Exporting Countries.
Dissert. Abstr.

N77-14955*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PERFORMANCE CHARACTERISTICS OF A DIESEL ENGINE USING LOW- AND MEDIUM-ENERGY GASES AS A FUEL SUPPLEMENT (FUMIGATION)
Leo G. Monford Oct. 1976 23 p refs
(NASA-TM-X-58188; JSC-11404) Avail: NTIS HC A02/MF A01 CSCL 21A

The use of low- and medium-energy gases derived from solid waste is investigated. Gases that simulate those gases that could be derived from refuse were injected into the air inlet of a 298-kilowatt (400 horsepower) diesel engine as a fuel supplement. This process is called fumigation. Three different gases with thermal-energy contents of 6.11 MJ/cu m (164 Btu/cu ft), 18.1 MJ/cu m (485 Btu/cu ft), and 18.8 MJ/cu m (505 Btu/cu ft, respectively, were used at rates ranging as high as 20 percent of the normal fuel oil energy at four different engine load points. The test results indicated approximately 100 percent gas energy utilization with no observable deleterious effect on the engine. Author

N77-14956*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUTOMATED MIXED TRAFFIC VEHICLE CONTROL AND SCHEDULING STUDY Final Report, Feb. - Oct. 1976
Ted K. C. Peng and Kilnam Chon Dec. 1976 65 p refs
(Contract DOT-AT-60008)
(NASA-CR-149279; JPL-5040-45;
UMTA-RD-CA-06-0088-76-1) Avail: NTIS HC A04/MF A01 CSCL 13F

The operation and the expected performance of a proposed automatic guideway transit system which uses low speed automated mixed traffic vehicles (AMTVs) were analyzed. Vehicle scheduling and headway control policies were evaluated with a transit system simulation model. The effect of mixed traffic interference on the average vehicle speed was examined with a vehicle pedestrian interface model. Control parameters regulating vehicle speed were evaluated for safe stopping and passenger comfort. Some preliminary data on the cost and operation of an experimental AMTV system are included. These data were the result of a separate task conducted at JPL, and were included as background information. Author

N77-14957# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
UTILITY DISTRIBUTION SYSTEMS IN ICELAND
H. W. C. Aamot May 1976 69 p
(DA Proj. 4A7-62719-AT-06)
(AD-A026956; CRREL-SR-76-5) Avail: NTIS HC A04/MF A01 CSCL 13/2

The study reports on new developments and special problems or solutions in water distribution systems, sewage collection systems, heat distribution and electric transmission systems in Iceland. Cold weather considerations are highlighted. For water and sewage transport, the use of ductile iron, concrete and plastic materials is reported. Utility lines are generally placed individually. Heat distribution with hot water from geothermal wells is mostly one-way piping. After heating, the water is discharged through the sewage system. Street heating is being expanded. With electric distribution, the use of self-supporting aerial cables is becoming popular because it is very cost-effective and reliable. Within the city, all distribution is under ground. Arcing of isolators on high voltage transmission lines due to salt from the ocean atmosphere is being reduced with silicone fluids. GRA

N77-14958# Transportation Research Board, Washington, D.C.
INNOVATIONS IN TRANSPORTATION SYSTEM PLANNING
Walter G. Hansen 1976 94 p refs Presented at the 54th Ann. Meeting of the Transportation Res. Board, Washington, D. C., 1976
(PB-256972/1; TRB/TRR-582; ISBN-0-309-02496-X) Avail: NTIS HC A05/MF A01 CSCL 13B

Seven papers on various aspects of transportation planning ranging from state and regional planning to metropolitan and subcommunity planning are presented. They include (a) review of the metropolitan transportation planning process of the 1960s; (b) discussion of the community aggregate planning model; (c) discussion of circulation simulation model to be used in a heuristic method of evaluating and selecting from alternative transit designs; (d) presentation of a conceptual approach to formulate a more comprehensive program for studying and improving trails for park and recreational areas; (e) discussion of the purposes and objectives of the Regional Rail Reorganization Act of 1973; (f) a report on the progress being made in developing a regional simulation model that is interactive and linked with employment, population, land use, and transportation components; and (g) discussion of experience in Wisconsin as it relates to state-regional transportation planning. GRA

N77-14959# University of Southern Mississippi, Hattiesburg. Bureau of Business Research.
DEVELOPMENT OF REGIONAL WATER MANAGEMENT SYSTEMS OPERATIONAL PROCEDURES
David J. Etzold and D. C. Williams, Jr. Jul. 1976 44 p refs Prepared in cooperation with Miss. State Univ., Miss. State

Sponsored by Interior Dept.
(PB-256571/1; W76-11329; OWRT-A-094-MISS(1)) Avail: NTIS HC A03/MF A01 CSCL 13B

Multigovernmental constraints inherent in regional water supply development were identified, and an organizational and procedural framework was generated. Current water supply problems in Southeast Mississippi, in general, and Jackson County, in particular, are discussed. Governmental agencies with water development and management jurisdiction in Jackson County are identified. Thirteen officials and professionals were interviewed for the purpose of deriving their views on development of a regional water supply system. GRA

N77-14960# Arizona Univ., Tucson. Dept. of Nuclear Engineering.
FEASIBILITY STUDY OF A NUCLEAR POWER-SEWAGE TREATMENT SYSTEM FOR THE CONSERVATION AND RECLAMATION OF WATER RESOURCES
Rocco Fazzolare 1976 13 p refs
(Contract DI-14-31-0001-3503)
(PB-255630/6; W76-10614; OWRT-A-028-ARIZ(4)) Avail: NTIS HC A02/MF A01 CSCL 13B

A ferric-chloride, powdered activated carbon and an aluminum sulfate, powdered activated carbon physical chemical system were examined in a one-step process as a function of temperature. COD, suspended solids, turbidity and phosphorus removals were used to monitor performance. Significant improvement in pollutant removals was obtained at higher temperatures with the optimum results occurring between 50 and 60 C. Since urban wastewater flow and electric power usage are population-dependent and the system optimum treatment temperature coincides with waste heat characteristics, a combined power plant-wastewater system would generate recyclable water. GRA

N77-14961# Environmental Protection Agency, Washington, D.C. Municipal Construction Div.
COST-EFFECTIVE COMPARISON OF LAND APPLICATION AND ADVANCED WASTEWATER TREATMENT
Charles E. Pound, Ronald W. Crites, and Robert G. Smith Nov. 1975 33 p refs
(PB-257448/1; EPA-430/9-75-016) Avail: NTIS HC A03/MF A01 CSCL 13B

Cost comparison of AWT and land application systems and irrigation systems under variable site conditions were investigated. The variation of cost with conveyance distance and flow capacity and land price resulting in equal total costs of AWT and land application systems were studied. Federal and local share of total costs and cost component tables are given. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N77-14962*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HERCULES X-1: SPECTRAL VARIABILITY OF AN X-RAY PULSAR IN A STELLAR BINARY SYSTEM Ph.D. Thesis
Steven Howard Pravdo Dec. 1976 168 p refs
(Grant NGR-21-002-316)
(NASA-TM-X-71247; X-661-76-280) Avail: NTIS HC A08/MF A01 CSCL 03A

A cosmic X-ray spectroscopy experiment onboard the Orbiting Solar Observatory 8 (OSO-8), observed Her x-1 continuously for approximately 8 days. Spectral-temporal correlations of the X-ray emission were obtained. The major results concern observations of: (1) iron band emission, (2) spectral hardening (increase in effective x-ray temperature) within the X-ray pulse, and (3) a transition from an X-ray low state to a high state. The spectrum obtained prior to the high state can be interpreted as reflected emission from a hot coronal gas surrounding an accretion disk, which itself shields the primary X-ray source from the line of sight during the low state. The spectral hardening within the X-ray pulse was indicative of the beaming mechanism at the neutron star surface. The hardest spectrum by pulse phase was identified with the line of sight close to the Her x-1 magnetic dipole axis, and the X-ray pencil beam become harder with decreasing angle between the line of sight and the dipole axis. Author

N77-14963*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Physics.
ON THE INFRARED POLARIZATION OF THE ORION NEBULA
Brian Dennison [1976] 16 p refs
(Grant NGR-33-010-146)
(NASA-CR-149366) Avail: NTIS HC A02/MF A01 CSCL 03A

The implications of the 10 micron polarization of the Orion Nebula were re-examined. The polarization was produced by preferential extinction in one of the well studied regions of the Kleinman-Low Nebula and/or its surroundings. In particular, the need for abnormally low temperatures in the polarizing medium was obviated. The most likely candidate for the polarizing medium was the extended region surrounding the Kleinman-Low Nebula. The degree of polarization produced by emission in the far infrared was estimated to be as large as 8 percent, although other factors could reduce the observable value. Author

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N77-14964 Princeton Univ., N.J.
THE ROLE OF DUST IN H 2 REGIONS Ph.D. Thesis
Craig Leigh Sarazin 1975 283 p
Avail: Univ. Microfilms Order No. 76-23810

An analytic theory is presented which describes three effects of dust in H II regions. Numerical models of II regions with dust were constructed. The ionization and thermal structure of these model H II regions are discussed. The observational consequences of the presence of dust are explored; the optical line intensities, radio continuum and line fluxes, and infrared emission of model H II regions with dust are given. These numerical models are compared with observations of diffuse nebulae. The optical line ratios are compared to several nearby bright H II regions, and it is found that the dust models may explain several anomalies in their spectrum. The ionized helium abundances and infrared emission of galactic H II regions are shown to require a very rapid increase in dust absorption with frequency in the Lyman continuum, if the variations in these quantities and their correlation are due to the presence of dust. Dissert. Abstr.

N77-14965 Toledo Univ., Ohio.
DETERMINATION OF THE PHYSICAL CONDITIONS IN SEYFERT GALAXY NUCLEI USING THE FAST PROTON MODEL Ph.D. Thesis
Edward Kimmer 1976 66 p
Avail: Univ. Microfilms Order No. 76-24924

The fast proton model was used to determine physical conditions in a hydrogen gas heated by suprathermal protons. The electron temperature and degree of ionization of the gas were found, as a function of the penetration distance of the fast particles, by solving the ionization and thermal balance equations at each point. The conditions were determined for an optically thin gas where all radiation produced in the gas escapes without being scattered, and an optically thick gas where L alpha radiation is trapped and degraded by two-photon emission. The model parameters were the incident energy of the fast protons, the ambient gas density, and the fast particles density. Estimates were also made of the conditions in the gas when broad-line

emission by suprathermal atoms is enhanced via absorption of line photons produced by the ambient gas. Dissert. Abstr.

N77-14966 Texas Univ., Austin.
METALLICISM AND PULSATION: AN ANALYSIS OF THE DELTA DELPHINI STARS Ph.D. Thesis
Donald Wayne Kurtz 1976 116 p
Avail: Univ. Microfilms Order No. 76-26654

Fine abundance analyses of seven delta Delphini stars and one delta Scuti star relative to four comparison standards are presented. Five of the delta Del stars were shown to have abundances most similar to the evolved Am stars. It was argued that these abundances are different from the classical Am star and Ap star abundances and that similarities to the Ba II star abundances are coincidental. The anomalous abundance delta Del stars were evolved metallic line stars on the basis of their abundances, position in the beta, MY plane, inferred rotational velocities, and perhaps their binary incidence. Some of the delta Del stars are delta Scuti pulsators. Pulsation and metallicism were mutually exclusive among the classical Am stars but may coexist in other stars related to the classical AM stars. A preference for the diffusion hypothesis model for the metallic line stars is stated and supported, and the implications of the coexistence of pulsation and diffusion are discussed. Dissert. Abstr.

N77-14967# Lockheed Missiles and Space Co., Palo Alto, Calif.
INTERPLANETARY MAGNETIC FIELD AND LONG-PERIOD GEOMAGNETIC PULSATIONS IN THE MIDDLE LATITUDES
Ia. M. Gogatishvili 1976 3 p refs Transl. into ENGLISH from Geomagn. i Aeron. (Moscow), v. 16, no. 2, 1976 p 382-384
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The relation between the appearances and distributions of long-period pulsations and the interplanetary magnetic field parameters is considered. To this end, absolute values of the interplanetary field intensity B and the components Bz of this field, normal to the plane of the ecliptic and measured at 5 minute intervals on the IMP-3 satellite were compared with long-period pulsations observed at Dusheti during a storm. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N77-14968*# Rice Univ., Houston, Tex. Dept. of Geology.
APOLLO 15 COARSE FINES (4-10 MM): SAMPLE CLASSIFICATION, DESCRIPTION AND INVENTORY Final Technical Report
Benjamin N. Powell NASA Feb. 1972 92 p refs
(Grant NGR-44-006-142)
(NASA-CR-149344; MSC-03228) Avail: NTIS HC A05/MF A01 CSCL 03B

A particle by particle binocular microscopic examination of all of the Apollo 15 4-10 mm fines samples is reported. These particles are classified according to their macroscopic lithologic features in order to provide a basis for sample allocations and future study. The relatively large size of these particles renders them too vaulable to permit treatment along with the other bulk fines, yet they are too small (and numerous) to practically receive full individual descriptive treatment as given the larger rock samples. This examination, classification and description of subgroups represents a compromise treatment. In most cases and for many types of investigation the individual particles should be large enough to permit the application of more than one type of analysis. Author

N77-14969*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FISCAL YEAR 1976 PROGRESS REPORT ON A FEASIBILITY STUDY EVALUATING THE USE OF SURFACE PENETRATORS FOR PLANETARY EXPLORATION
M. B. Blanchard, V. R. Oberbeck, T. E. Bunch, R. T. Reynolds, T. N. Canning, and R. W. Jackson Nov. 1976 284 p refs
(NASA-TM-X-73181; A-6814) Avail: NTIS HC A13/MF A01 CSCL 03B

The feasibility of employing penetrators for exploring Mars was examined. Eight areas of interest for key scientific experiments were identified. These include: seismic activity, imaging, geochemistry, water measurement, heatflow, meteorology, magnetometry, and biochemistry. In seven of the eight potential experiment categories this year's progress included: conceptual design, instrument fabrication, instrument performance evaluation, and shock loading of important components. Most of the components survived deceleration testing with negligible performance changes. Components intended to be placed inside the penetrator forebody were tested up to 3,500 g and components intended to be placed on the afterbody were tested up to 21,000 g. A field test program was conducted using tentative Mars penetrator mission constraints. Drop tests were performed at two selected terrestrial analog sites to determine the range of penetration depths for anticipated common Martian materials. Minimum penetration occurred in basalt at Amboy, California. Three full-scale penetrators penetrated 0.4 to 0.9 m into the basalt after passing through 0.3 to 0.5 m of alluvial overburden. Maximum penetration occurred in unconsolidated sediments at McCook, Nebraska. Two full-scale penetrators penetrated 2.5 to 8.5 m of sediment. Impact occurred in two kinds of sediment: loess and layered clay. Deceleration g loads of nominally 2,000 for the forebody and 20,000 for the afterbody did not present serious design problems for potential experiments. Penetrators have successfully impacted into terrestrial analogs of the probable extremes of potential Martian sites. Author

N77-14053*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A RADAR STUDY OF THE BACKUP MARTIAN LANDING SITES
G. S. Downs, R. R. Green, and P. E. Reichley *In its* The Deep Space Network 15 Dec. 1976 p 49-52 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N77-14970 Princeton Univ., N.J.
ON THE POWER SPECTRUM OF THE SOLAR GRANULATION AT HIGH WAVE NUMBERS Ph.D. Thesis
Blake Francis Kinahan 1975 45 p
Avail: Univ. Microfilms Order No. 76-25093

Using the McMath solar telescope and the combined techniques of photoelectric speckle interferometry and wave front division interferometry, the two dimensional power spectrum of the solar granulation for spatial frequencies between one and two cycles per arc second was determined. The effective modulation transfer function of the telescope-atmosphere-scanning slit combination was determined under the assumption that the telescope is aberration-free and that the effect of the atmosphere is to cause separate tilts of the two sections of the divided wave-front over their respective apertures. Statistical information on this tilting was determined from limb data. The results of the observations and the calibration indicate that there is a significant amount of power in this spatial frequency range. Dissert. Abstr.

N77-14971*# Stanford Univ., Calif. Inst. for Plasma Research.
EVAPORATIVE COOLING OF FLARE PLASMA
S. K. Antiochos and P. A. Sturrock Nov. 1976 25 p refs
(Contract N00014-75-C-0673; Grant NGL-05-020-272)
(NASA-CR-149368; SU-IPR-676) Avail: NTIS HC A02/MF A01 CSCL 03B

A one-dimensional loop model for the evaporative cooling

of the coronal flare plasma was investigated. Conductive losses dominated radiative cooling, and the evaporative velocities were small compared to the sound speed. The profile and evolution of the temperature were calculated. The model was in agreement with soft X-ray observations on the evolution of flare temperatures and emission measures. The effect of evaporation was to greatly reduce the conductive heat flux into the chromosphere and to enhance the EUV emission from the coronal flare plasma.Author

N77-14972# California Univ., Livermore. Lawrence Livermore Lab.
ONE-WAVELENGTH SOLAR RADIATION CALCULATIONS: RAYLEIGH SCATTERING AND GASEOUS ABSORPTION
F. M. Luther Feb. 1976 29 p refs Presented at 2d Conf. on Atmospheric Radiation, Arlington, Va., 29-31 Oct. 1975 Sponsored in part by the High Altitude Pollution Program of the FAA
(Contract W-7405-eng-48)
(UCRL-76680; Conf-751098-1) Avail: NTIS HC A03/MF A01

One-wavelength calculations were compared with full-flux calculations in order to better understand the limitations and uncertainties of the results when only the wavelength was used. Comparisons were made for a standard atmosphere without aerosols. The case of a standard atmosphere with tropospheric and stratospheric aerosols was studied. Calculations at a wavelength of 0.55 micrometers shown to overestimate Rayleigh scattering, with the best agreement occurring at 0.57 micrometers. The wavelength which gives the best agreement with the full-flux calculation (including Rayleigh scattering gaseous absorption) varied greatly with solar zenith angle, surface albedo, and height for each flux component. ERA

N77-14973# Naval Research Lab., Washington, D.C.
THE EFFECTS OF SOLAR FLARES ON THE IONOSPHERE
E. Oran, L. Baker, and T. R. Young May 1976 31 p refs
(AD-A026630; NRL-MR-3296) Avail: NTIS HC A03/MF A01 CSCL 04/1

A model has been developed which describes the response of the earth's ionosphere to the enhanced soft x-ray and EUV radiation accompanying solar flares. Time-dependent changes in electron and ion densities in the D, E, and F regions are calculated and compared to results from calculations made for unperturbed conditions. GRA

N77-14974# Brandeis Univ., Waltham, Mass. Dept. of Physics.
SOLAR ATMOSPHERIC DYNAMICS
R. F. Stein and S. H. Hsieh Jan. 1976 30 p refs
(Contract F19628-75-C-0013; AF Proj. 7649)
(AD-A027512; Scientific-1; AFCRL-TR-76-0034) Avail: NTIS HC A03/MF A01 CSCL 03/2

This study, aimed at calculating the heating of the solar chromosphere and corona, started with the analysis of magneto-acoustic-gravity wave vector surfaces. To permit non-linear calculation of the excitation and propagation of these waves the equations of motion were written for an imposed horizontal structure -- namely six waves of the same wavelength propagating in an hexagonal pattern. Author (GRA)

N77-14975# Air Weather Service, Scott AFB, Ill.
DEVELOPMENT/DECAY POTENTIAL OF ACTIVE SOLAR REGIONS FROM A FULL-DISK NEUTRAL-LINE ANALYSIS
Jerry D. Farley Apr. 1976 26 p refs
(AD-A026303; AWS-TR-76-262) Avail: NTIS HC A03/MF A01 CSCL 03/2

A full-disk neutral-line analysis technique and the relationship of solar active regions to the large-scale magnetic features are discussed. A classification of basic configurations and variations on these configurations are developed to aid in the prediction of development/decay of active solar regions. Examples of these configurations are presented and are discussed in terms of the evolution of actual disk regions. Author (GRA)

N77-14062*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE 1976 HELIOS AND PIONEER SOLAR CONJUNCTIONS-CONTINUING CORROBORATION OF THE LINK BETWEEN DOPPLER NOISE AND INTEGRATED SIGNAL PATH ELECTRON DENSITY
A. L. Berman, J. A. Wackley, and S. T. Rockwell *In its* The Deep Space Network 15 Dec. 1976 p 121-137 refs (For primary document see N77-14044 05-12)
Avail: NTIS HC A08/MF A01 CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N77-14976*# Kanner (Leo) Associates, Redwood City, Calif.
EXPERIMENTAL AND THEORETICAL FUNDAMENTALS OF THE ASTROPHYSICS OF COSMIC RAYS
L. I. Dorman Washington NASA Dec. 1976 526 p refs Transl. into ENGLISH of the book "Eksperimentalnyye i Teoreticheskiye Osnovy Astrofiziki Kosmicheskikh Luchey" Moscow, Nauka Press, 1975 p 1-462
(Contract NASw-2790)
(NASA-TT-F-16625) Avail: NTIS HC A23/MF A01 CSCL 03B

Cosmic ray astrophysics is a fast developing scientific discipline, at the frontier of cosmic ray physics, astrophysics, solar physics, and cosmic plasma physics. An examination is made of the interaction of fast particles with cosmic plasma, the shaping of energy and charge spectra, and temporal and spatial variations in the intensity and anisotropy of cosmic rays. An analysis is made of current experimental methods of studying cosmic rays from the astrophysical point of view (ground, balloon, satellite, and spacecraft measurements, measurements of superhigh-energy particles, and the method of cosmogenic isotopes in the earth's atmosphere, meteorites, and lunar specimens. Author

N77-14977*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEARCH FOR GAMMA RAY BURSTS WITH COINCIDENT BALLOON FLIGHTS
T. L. Cline, U. D. Desai, W. K. H. Schmidt, and B. J. Teegarden Dec. 1976 13 p refs
(NASA-TM-X-71250; X-661-76-278) Avail: NTIS HC A02/MF A01 CSCL 03B

A search was conducted for cosmic gamma ray bursts of small size and of sufficient frequency of occurrence to be detected during a one day observation program. Two similar detectors, successfully balloon-borne from launch sites in South Dakota and Texas, achieved about 20 hours of simultaneous operation at several millibars atmospheric depth, with continuous separation of over 1,500 km. Fluctuations of the counting rates of less than 150 keV photons with temporal structures from microseconds to several minutes were compared in order to detect coincident or associated responses from the two instruments. No coincident gamma-ray burst events were detected. The resulting integral size spectrum of small bursts, from this and from all other searches, remains a spectrum of upper limits, consistent with an extrapolation of the size spectrum of the largest known bursts, fitting a power low of index -1.5. Author

N77-14978*# California Inst. of Tech., Pasadena.
THE STREAMING OF 1.3 - 2.3 MeV COSMIC-RAY PROTONS DURING PERIODS BETWEEN PROMPT SOLAR PARTICLE EVENTS Ph.D. Thesis
Francis E. Marshall 1977 176 p refs
(Contract NAS5-11066; Grant NGR-05-002-160)
(NASA-CR-149347) Avail: NTIS HC A09/MF A01 CSCL 03B

The anisotropy of 1.3 to 2.3 MeV protons in interplanetary space was measured using the Caltech electron/isotope spectrometer aboard IMP-7 for 317 6 hour periods from 72/273 to 74/2. Periods dominated by prompt solar particle events are not included. The convective and diffusive anisotropies were determined from the observed anisotropy using concurrent solar wind speed measurements and observed energy spectra. The

diffusive flow of particles was found to be typically toward the sun, indicating a positive radial gradient in the particle density. This anisotropy was inconsistent with previously proposed sources of low energy proton increases seen at 1 AU which involve continual solar acceleration. The typical properties of this new component of low-energy cosmic rays were determined for this period which is near solar minimum. Author

N77-14979# Ballistic Research Labs., Aberdeen Proving Ground, Md.

THE ION PAIR PRODUCTION RATE DUE TO COSMIC RAYS Final Report

Melvin G. Heaps Jun. 1976 22 p refs

(DA Proj. 1T1-62111-AH-71)

(AD-A027629; BRL-MR-2641) Avail: NTIS HC A02/MF A01 CSCL 04/1

Galactic cosmic rays are the primary source of ionization in the stratosphere at all times and are the primary source in the lower mesosphere at night and during solar eclipses. The ion-pair production rate is given as a simple function of latitude and height (using pressure as the variable). The solar cycle variation may be included by the use of a simple sinusoidal variation.

Author (GRA)

99 GENERAL

No abstracts in this category.

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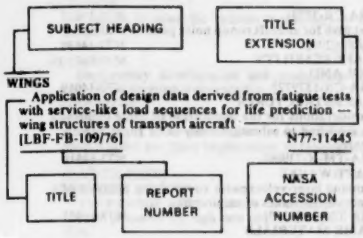

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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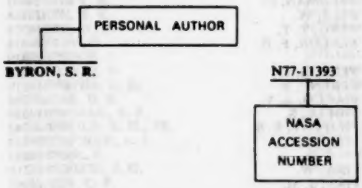

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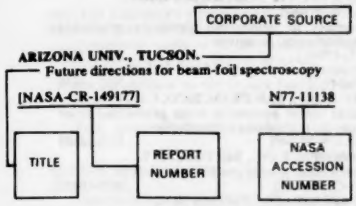

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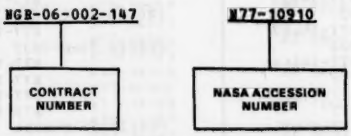

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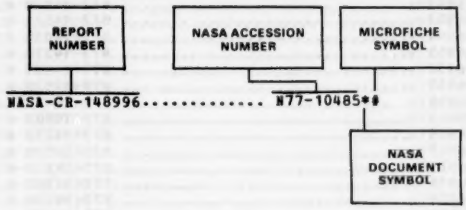

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